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THE IRON TRADE REVIEW

Volume LIV Cleveland, May 7, 1914 *No. 19*

Scattering Some Dark Clouds

But Many Still Obscure the Sky and Substantial Evidence of Improvement is Lacking

Positive evidence of improvement in iron and steel products is still lacking, but more interest in pig iron buying and a better feeling are noted. The production of the Steel Corporation continues at about 65 to 70 per cent of ingot capacity. The activities of independent companies vary to a considerable extent. Railroad buying shows some improvement, especially in lighter materials. The Erie railroad has closed for 14,000 tons of rails, of which 12,000 tons will be furnished by the Carnegie Steel Co. and 2,000 by the Illinois Steel Co. Other rail orders amount to about 6,000 tons. Very active competition and low prices on fabricating and erecting new buildings have not resulted in much new buying. More than half of the cities of the country show a falling off in new construction for April, as compared with April of last year, but even in cities where a gain has been made, as in Cleveland, the tonnage of structural steel is light and that of reinforcing bars only fair.

Pig Iron

Some relief from the doleful tale of dullness in the pig iron market came this week and a slight increase in activity was noted in different parts of the country, especially in basic. The purchase of 10,000 tons of basic by a St. Louis company at $14.50, delivered, aroused much interest. A number of other inquiries for basic, including one for 15,000 tons for the United Steel Co., Canton, are pending. In New York territory, inquiries are out for 5,000 tons of foundry grade and a consumer of low phosphorus iron is inquiring for his tonnage needed for the last half. While buying is still light, some sellers in New York report that they sold more iron in the first few days of May than in all of April. A large purchase by a pipe company at an early date is probable.

Iron Ore

The announcement, on May 1, that the very low prices of 1912 on Lake Superior iron ore would prevail this year came as a surprise, but it has been apparent for some time that furnaces would not place orders or even make reservations until prices were made known. They still hesitate and sales made have been inconsequential, but the delay in placing orders is due to uncertainty as to tonnage which will be required and not to the expectation that further concessions will be granted. The merchant furnaces which are not carrying heavy stocks are pleased with the new prices, but some steel companies having heavy stocks of ore on hand would have been glad to see higher prices prevail. Particularly in the east is the schedule received with favor. The reductions, as compared with the 1913 prices, are 65 cents per ton on Bessemer ores, 60 cents on old range non-Bessemer, and 55 cents on Mesabi non-Bessemer.

The new prices on non-Bessemer Mesabi figure 8.35c per unit, delivered in the Lehigh and Schuylkill valleys, as against 9.4c the past year. These prices mean that foreign ore, to be competitive, must sell at least at 7 cents per unit tidewater, as the average freight from the seaboard to the furnaces is about 1 cent per unit.

Finished Material

Although weakness appears here and there in finished materials, prices show considerable power of resistance. Very low prices on shapes reported in the east are for eastern delivery, for which 1.10c, Pittsburgh, can be done. On steel bars 1.15c, Pittsburgh, is the best price that very large consumers have been able to obtain. Semi-finished steel is weak.

THE OPEN HEARTH

The Virus of Muckraking

A PROMINENT New York banker says the country is suffering from "a hysteria of criticism". His words sound familiar, but they have a true ring. The attacks in recent years on about everything in this country worth attacking, seem to have had the not unnatural effect of making distrust and suspicion more conspicuous qualities in the every-day life of the average individual. Men are less certain of their rights and proprieties under the law, more cautious to act and withal, more timid to set themselves in front as a target to be shot at by the hair-trigger agitators and reformers, the criers of raw and untried ideas. Business has been hedged about, restrained and disheartened, apparently, by this deplorable situation. Witness the general loss of confidence from which the country now is suffering. This result was bound to come and its causes can be laid as far back as the day when wholesale agitation and the criticism of "the other fellow" became the order of the age in this country.

There is some cause for comfort, however, in counter-influences that now are at work. Wherever business men in the same or dissimilar lines of effort attempt honestly to understand and study each other's conditions for mutual benefit, this pall of doubt obstructing the horizon of the commercial future is being lifted. Men are finding in closer and franker relations with one another the means of gaining the understanding that their own distrust and lack of unity have been fanning the flames of the general uneasiness and unrest. If the association movement now shown in many lines of trade does nothing more than to give each individual participating a saner, less distorted and, in all, a fairer opinion of his competitor, it will have accomplished a notable work which eventually must bear fruit in the re-establishment of more stable and natural conditions of business life in this country.

What Does It Mean?

THE so-called Clayton anti-trust bill, which has just been reported to the House of Representatives, contains the following section:

Sec. 6. That nothing contained in the anti-trust laws shall be construed to forbid the existence and operation of fraternal, labor, consumers, agricultural or horticultural organizations, orders or associations operating under the lodge system, instituted for the purposes of mutual help, and not having capital stock or conducted for profit, or to forbid or restrain individual members of such orders or associations from carrying out the legitimate objects of such association.

This section is a fair sample of other provisions which are certain to cause endless controversy if they should be placed upon the statute book. Already widely varying opinions are being expressed as to what this section means. In the first place, there is ample opportunity for disagreement as to what the legitimate objects of the various associations are. Some people might be unkind enough to suggest that it would not be right for an agricultural organization to do anything but study agriculture. These people might insist that it would not be consistent with sound public policy to permit farmers to organize for the purpose of advancing prices. Perhaps Mr. Clayton thinks that if the cost of maintaining his household were increased in this way, he would have no right to object but courts might decide that such a combination of farmers to advance prices would be unlawful. If not, why would it not be entirely proper for any kind of manufacturers to unite to regulate prices?

If, however, the probable effect of the law as to agricultural people is doubtful, even more perplexing questions arise when one tries to imagine how the courts would construe the law as applied to labor organizations. Everybody knows that the principal object of every labor organization is to advance wages and reduce hours and that nearly all labor organizations attempt to monopolize the market. In other parts of the bill, which we shall not take up for discussion at the present time, it is manifestly the object to legislate in favor of labor

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unions. Was that the purpose of this section? Evidently it was. If, however, the section does not authorize labor monopoly, what does it do? No object would be accomplished by simply providing that nothing contained in the anti-trust laws should be construed to forbid the existence of labor unions.. Nobody has even claimed that the labor union properly organized and conducted is illegal. All that has ever been asserted by employers was in opposition to violence and unreasonable exactions of labor unions.

Under the rules of the House, a party having a large majority can force through almost any kind of legislation and we shall not be surprised to see the Clayton bill passed by the House, but we do not believe that section 6 and other sections which are either positively dangerous or so vague as to make certain unlimited litigation, would be able to stand up before the fire which will be directed against them in the Senate. We believe that manufacturers and others who are interested in the promotion of sane legislation would do well to study the Clayton bill and take it up for candid discussion by letter or otherwise with their representatives in the United States Senate.

Fundamental Differences

DURING the recent hearings before the United States Commission on Industrial Relations, James A. Emery, of the National Association of Manufacturers, gave some testimony which has not received the attention which it deserved from the newspapers. Mr. Emery was discussing the very important question, "Why does collective bargaining fail?" With his usual clearness and force, he explained to the Commission that collective bargaining cannot be successfully carried on because of the vital differences in principle between most labor unions and employers.

Mr. Emery referred to the famous report of the anthracite coal strike commission of 1902 and declared that the most vital principle there vindicated is the recognition of the elementary truth that while the organization of labor is an important and vital thing and has played a big part in the betterment of the wage earner, the right of any man to stay outside of the union and sell his labor and of every other man to purchase it, is indispensible in a free government.

"There can be," said Mr. Emery, "no security for the future if we do not recognize equally in this country and enforce the right of the manufacturer or the laborer to sell his commodity or his labor individually or in lawful combination as he may choose, without threat or attack." It is noteworthy that Mr. Emery concedes that the workman should be allowed to combine with other workman in a lawful way to sell his labor and, in conclusion, he says that many manufacturers would deal with efficient open shop unions, but they will not deal with irresponsible, inefficient closed shop unions; in other words, the unions must admit, as the Brotherhood of Locomotive Engineers does, that men have a right not to join a union and the union men must be ready to work with non-union men. If this fundamental principle could be established, a long step toward making collective bargaining possible would be attained.

The Drunkard Must Go

SOME remarkable decisions are being rendered now-a-days under various employers' liability acts in the different states. A striking example of what may happen in case an accident is taken to court has been furnished recently in Massachusetts. On account of a man being intoxicated, a fellow employe was injured for life. The suit resulted in a verdict for $20,000 against the owners of the plant where the man was employed. This decision has been upheld by the supreme court of the state, which used the following language:

"A drunken employe is a human parallel to the fragment of physical equipment which may be classified as defective material and cause injury to workmen. If one workman is injured through a drunken workman, the employer's responsibility does not lessen because of the intoxication. The employer whose defective equipment is the cause of the injury is responsible. The employer whose workman causes injury to fellow workmen is also responsible."

The justice of this decision may be disputed, but the most important fact in connection with it is that it will make employers more determined to eliminate intemperate men from their works. It is daily becoming more apparent that the drunkard must go, not only from the railroad trains, but from every kind of industrial pursuit where it is possible for him to cause the injury or death of a fellow workman.

Prices Present and Past

Quotations on leading products today, average for last month, average for three months ago and average for April, 1913. Prices are those ruling in the largest percentage of sales at the dates named.

	Today's prices.	Average for April, 1914.	Average for Feb., 1914.	Average for May, 1913.
Bessemer pig iron, Pittsburgh..	$14.90	$14.90	$15.09	$17.90
Basic pig iron, Pittsburgh.....	13.90	13.90	14.09	15.46
No. 2 Fdy. pig iron, Pittsburgh	14.15	14.15	14.09	15.04
Northern No. 2 Fdy., Chgo....	14.25	14.25	14.25	16.50
Ferro manganese, Baltimore....	38.00	38.50	36.50	61.75
Lake Superior Charcoal, Chgo.	16.00	16.00	18.50	18.00
Malleable Bessemer, Chicago...	14.25	14.25	14.25	16.50
Southern No. 2, Birmingham..	10.50	10.50	10.50	11.70
Southern Ohio No. 2, Ironton.	13.50	13.50	13.00	15.00
Basic, eastern Pa.....	14.00	14.25	14.25	16.50
No. 2X Virginia furnace.....	12.75	12.75	12.75	14.50
No. 2X Foundry, Philadelphia.	15.00	15.00	15.00	17.00
Bessemer billets, Pbgh. & Ygn.	20.00	20.80	21.00	26.50
Op. h'th billets, Pbgh. & Yn..	20.00	20.80	20.75	26.50
Bess. sheet bars, Pbgh. & Yn.	21.00	21.60	22.00	27.50
Op. h'th sh. bars, Pbgh. & Yn.	21.00	21.60	21.75	27.50
Steel bars, Pittsburgh.....	1.15	1.20	1.20	1.40
Iron bars, Philadelphia.....	1.22	1.22	1.27	1.57
Steel bars, Chicago.....	1.30	1.43	1.43	1.58
Tank plates, Chicago.....	1.30	1.33	1.38	1.63

	Today's prices.	Average for April, 1914.	Average for Feb., 1914.	Average for May, 1913.
Structural shapes, Chicago....	$1.30	$1.35	$1.38	$1.63
Iron bars, Cleveland.....	1.20	1.25	1.30	1.63
Iron bars, Chgo. mill.....	1.10	1.15	1.20	1.57½
Beams, Pittsburgh	1.15	1.18	1.20	1.45
Beams, Philadelphia	1.25	1.30	1.30	1.60
Tank plates, Pittsburgh.....	1.15	1.15	1.20	1.45
Tank plates, Philadelphia.....	1.30	1.30	1.30	1.75
Sheets, blk., No. 28, Pittsburgh	1.85	1.92	1.94	2.28
Sheets, blue ann., No. 10, Pbgh.	1.40	1.40	1.40	1.75
Sheets, galv., No. 28, Pbgh....	2.80	2.92	2.94	3.39
Wire nails, Pittsburgh.....	1.60	1.60	1.59	1.78
Connellsville fur. coke, contr..	2.00	2.00	1.92	2.25
Connellsville fdy. coke contr...	2.50	2.50	2.50	3.00
Heavy melting steel, Pbgh....	12.00	12.00	12.37	13.06
Heavy melting steel, east'n Pa.	11.00	11.00	10.50	12.50
Heavy melting steel, Chgo.....	10.00	10.25	9.70	12.50
Heavy cast, eastern Pa.....	13.00	13.00	12.50	13.50
No. 1 wrought, eastern Pa....	13.00	14.50	13.50	15.50
No. 1 wrought, Chgo.....	9.00	9.00	9.50	9.20
Rerolling rails, Chgo.....	11.75	11.75	11.63	14.00
Car wheels, Chgo.....	11.50	11.50	12.25	17.00

(For Additional Prices See Page 856.)

Eastern Furnace Men Pleased

With Reduction in Lake Ore Prices—St. Louis Company Buys Basic—Inquiry for Pig Iron Somewhat Improved

Reduction of lake ore prices representing about $1 per ton of pig iron is a source of gratification to Eastern Pennsylvania furnaces. While these producers do not use large quantities of lake ores, the new price schedule either directly or in competition with foreign and eastern ores promises to bring about some much-needed cutting of their costs. The iron market at Philadelphia and vicinity, while still very dull, is exhibiting some further softness in prices. Considerable of this weekness is in the form of quiet shading. Basic has declined to $14, delivered, or 25 cents under previous sales. Some selling involving 1,500 to 2,000 tons for second quarter in addition to that reported a week ago has been put through at this figure and several makers now will quote this level. Prices reported in recent sales of Bessemer for delivery in the district prove to have been too high, as this grade can be had at $16.50, delivered, and perhaps at $16. Small sales of standard low phosphorus at $21, Philadelphia, are being made, but it is stated this price now can be shaded, probably to meet recent quotations of English hematite. Though foundry sales are small, more of them appear to be going around $14.75, Philadelphia, which has been the minimum figure and some higher silicon lots have gone lower. Rolling mill forge in small lots is selling at $14, delivered, and some tentative negotiations for larger tonnages have been broached. A pipe maker remains in the market for 3,000 tons of low grade iron and the trade hears the United States Cast Iron Pipe & Foundry Co. may enter the market for a round tonnage soon, as it is known to have been considering this matter. Virginia quotations remain $12.75, furnace, for No. 2X, with $12.50 going for No. 2 plain. Virginia stacks are increasing. The Virginia Iron, Coal & Coke Co. has blown out one stack, leaving two in operation. The Temple, Pa., furnace may go out soon.

Basic Inquiry at Chicago

Signs of interest in basic pig iron in the Chicago market are evident. Since the purchase by the Commonwealth Steel Co., Granite City, Ill., of 10,000 tons of basic pig iron, a number of more or less tentative inquiries have been received by makers at Chicago. They aggregate 8,000 to 9,000 tons and consist of one for 1,000 tons, one for 2,000 tons, one for 3,000 tons and a fourth for a tonnage running from 2,000 to 3,000 tons. While these inquiries are not of the sort that is expected to lead to contracts unless the price is attractive, the fact that users of steel-making grades are beginning to think of their second half requirements indicates the market may be somewhat livelier during May than has been the case the past two months.

Pig iron makers here are approaching the end of the first half with practically nothing booked for second half and the situation is becoming more interesting as each week passes. The policy has been to quote a premium of 50c to $1 higher than first half quotations, with the idea of discouraging contracting until close to the middle of the year. This policy has been successful and the crucial point will be passed when the first few contracts are booked for second half.

Foundry irons are quiet and nothing but carload and small tonnages are being moved. Quotations remain steady at $14.25, Chicago furnace, for No. 2 foundry and malleable.

Southern iron has not changed its position and recent sales of small tonnages have been on a basis of $10.50, Birmingham, while some furnaces are holding for $11, but not sufficient business is being done to affect these quotations.

Demand for shipments of pig iron on contract is heavy in the St. Louis

(*For Complete Prices See Page* 856)

territory, but there is no new inquiry out. The 10,000 tons of northern basic purchased by the Commonwealth Steel Co. last week was sold at the price of $14.50, delivered. It is said that Ohio furnaces refused to quote less than $16, delivered. Southern No. 2 is quoted variously at $11, $10.75 and $10.50, Birmingham basis, for St. Louis delivery. Northern iron is offered at St. Louis at $14.25, Chicago furnaces, and $13.50, Ironton.

Interest in Cleveland

The placing of 10,000 tons of basic by the Commonwealth Steel Co., St. Louis, at $14.50, delivered, and the inquiry of the United Steel Co., of Canton, for 10,000 tons of basic for the third quarter's shipment have aroused much interest in Cleveland and relieved the dreariness of the market, which had existed for a number of weeks. The St. Louis order was not, however, taken by any Cleveland company. The delivery of foundry iron in the Cleveland district is not being kept up as well as it was a week or two ago. The fixing of prices on iron ore did not increase the activity of buyers of pig iron in Cleveland.

Sales at Cincinnati

The Commonwealth Steel Co., St. Louis, has closed for about 10,000 tons of basic iron for delivery extending into the second half. Other sales include 800 tons of silvery iron to a central Indiana melter, 300 tons of southern foundry iron and 300 tons of northern foundry iron, the latter at $15, delivered, also to a central Indiana user, and 1,100 tons divided between northern and southern foundry grades to an Indiana manufacturer. Inquiries before the market are for about 1,000 tons of foundry iron from a northern Ohio melter, and 1,000 tons from a Detroit, Mich., consumer.

Although from first appearance the market seems a little better, the situation in reality is unchanged and is still extremely dull and absolutely featureless. Prices are the same, those in the south being from $10.50 to $11, Birmingham basis, for shipment from the present time over the last half, including both Tennessee and Alabama makes.

Southern Ohio furnaces are holding at $13.50, Ironton, for No. 2 foundry iron for the second quarter, but it is not known that any sales have been made at this figure except to fill in when requirements on old contracts have run short.

One of the stacks of the Wellston Iron & Steel Co., Wellston, O., has been blown out for repairs.

Inquiry at Pittsburgh Better

The United Steel Co., Canton, O., is in the market for 15,000 tons of third quarter basic pig iron and Pittsburgh dealers report inquiry for third quarter delivery is fairly heavy. No sales of consequence have been made this week, and prices are unchanged. W. P. Snyder & Co., on May 1, announced the average price of Bessemer and basic in April was $14 and $13, valley, respectively. Compared with averages for March, Bessemer declined $0.1667 and basic $0.041. Blast furnace operations have been further reduced in this district, as shown by production figures, given elsewhere in this issue.

Forward Inquiry at New York

Buyers of iron in territory surrounding New York City have been inquiring a little more liberally for third quarter and last half. About 5,000 tons of foundry iron is current, the largest lot of which is 2,000 tons of No. 2X and 1,000 tons of No. 2 plain for last half for a Newark, N. J., buyer. A consumer of low phosphorus is inquiring for his last half requirements involving several thousand tons. An inquiry for 3,000 tons of mixed grades for Connecticut delivery may be closed this week. Sales remain light, but some sellers booked more tonnage the first week in May than during the whole of April. An Elizabeth, N. J., consumer took 600 tons of No. 1X and No. 2 plain at an average price of $14.50, delivered. W. M. Myers, Philadelphia, is low on 350 tons of No. 1X at $15.25, delivered, and on 200 tons of 2 to 2.50 silicon iron at $15, delivered, for the Brooklyn navy yard. A Massachusetts builder of textile machinery, inquiring for 1,000 to 1,500 tons of high phosphorus iron, has purchased only a small lot. A second small cargo of Wabana, Nova Scotia, iron has arrived at Bridgeport, Conn., for delivery to a consumer there. Some additional small lots of this iron have been sold to New England consumers at a shade below $15.25, delivered. The tidewater market remains $14.75 to $15, for No. 2X, but more furnaces seem to be accepting the minimum. Some further reports of resale Buffalo iron being offered in New England at below $13.50, furnace, are to be heard.

Inquiry Appearing at Buffalo

At Buffalo, the week has developed a small amount of inquiry from New England users and from the eastern portion of Pennsylvania. From the latter district there is included a 1,000-ton lot of foundry grades, but the new business has not been booked.

The furnaces of the Buffalo territory are still maintaining the price schedules on all grades which have prevailed for a number of weeks. The sales end of the market remains light, as the orders for the week amounted to about 1,500 tons of all grades. Producers, while reporting the market to be at a standstill as far as orders are concerned, say they are shipping a fair volume of iron on existing contracts.

The Wickwire Steel Co., Tonawanda, has for the present put its furnace "Y" out of blast.

Coke Market is Softer

A prominent consumer who contracted for 20,000 tons of April blast furnace coke at $2, ovens, has instructed the seller to continue shipping indefinitely at that figure, but it is difficult to say how long the contract will extend on account of the uncertainty of the market for pig iron. Spot furnace coke is being offered at $1.75, ovens. The *Connellsville Courier*, for the week ending April 25, says production was 313,757 tons, a decrease of 20,898 tons compared with the week before.

Buy Easily at $1.75

Cleveland buyers of furnace coke are having no difficulty in purchasing at $1.75, ovens, for prompt delivery, and express the opinion that they can purchase for delivery during the next three months at about the same price. Apparently no one is quoting more than $1.80, ovens, for furnace coke in the Cleveland district.

Quiet at Cincinnati

The market is at a standstill at Cincinnati and new contracts are at a minimum. Numerous requests have been received by dealers to withhold shipments on old contracts. A number of operators in the southern fields are running at 50 per cent of their capacities or less, and more ovens are being blown out each week. Prices on foundry coke are a little lower than those of last week, but furnace prices are unchanged in any of the fields. Wise county and Pocahontas foundry coke is quoted at from $2.40 to $3 per ton, ovens, and New River 72-hour grades are from $2.60 to $3.25, ovens.

Connellsville 72-hour foundry coke is held at $2.50, ovens, by St. Louis agents, and there is no inquiry.

(*For Complete Prices See Page 856*)

Bars Weak at Chicago

Prices Elsewhere Show Considerable Resistance

In common with all finished steel products soft steel bars in the Chicago district are a shade weaker with the quotation now 1.30c to 1.35c, Chicago, for the most desirable business, while the ordinary run would command 50c per ton higher. Railroads and agricultural implement makers still remain out of the market and so little business is going that actual prices depend entirely on the conditions surrounding each individual transaction.

Bar Steel Held 1.15c, Pittsburgh

Bar steel makers in the Pittsburgh district are refusing to shade 1.15c, and that figure apparently represents the bottom of the market, although it has not been severely tested. More important consumers, including nut, bolt and rivet makers, shafting interests and agricultural implement manufacturers, have not entered the market, except for immediate needs.

Concrete Bars Open in East

Inquiries for 4,000 to 5,000 tons of reinforcing bars by contractors continue before sellers in the Philadelphia district. One lot of 3,100 tons, as reported, is up. Ford buildings at Atlanta and Pittsburgh and a college building at Ann Arbor, Mich., will require about 1,000 tons, while some other orders are pending. Some waiving of twisting extras is reported, but on plain bars 1.30c, Philadelphia, or 1.15c, Pittsburgh, is held despite buyers efforts to shade. There is very little new business in ordinary steel bars in the Philadelphia district and specifications are sluggish.

A fair demand for reinforcing bars is appearing at New York and New England points, but otherwise the bar market remains indifferent there. Plain bars remain firm at 1.31c, New York, or 1.15c, Pittsburgh, but extras for twisting are being shaded. The Boston Transit Commission placed 150 tons of ½-inch deformed bars with the Jones & Laughlin Steel Co. at $27.40 per ton, delivered, and 100 tons of ⅝-inch bars with the Corrugated Bar Co. at $28.40, delivered. A shipment of about 1,200 tons of German bars recently was received by various Boston jobbers at a price of about 1.25c, delivered.

Dull in the East

Trade conditions with eastern Pennsylvania bar iron makers remain dull and prices are weak. Small lots are bringing out 1.22c, Philadelphia, and 1.20c is being done on attractive orders.

Bar Iron Nominal at Pittsburgh

The bar iron market in the Pittsburgh district continues quiet, but indications are that the prevailing price, considered nominal, could be shaded if an attractive tonnage were involved.

Shafting Weak at Pittsburgh

Shafting is not commanding above 65 per cent off list in the Pittsburgh district, and reports of sales at 66 per cent off are heard in isolated cases. Hoops and bands are quiet, but unchanged as to price. Although mills are rolling cotton ties, nothing has been done with reference to establishing prices.

Firm at 1.15c

In the Cleveland district 1.15c, Pittsburgh is the minimum quotation on steel bars and there are evidences that the market has been thoroughly tested and that further concessions will not be made. The building for the General Electric Co., at Fort Wayne, will require 1,000 tons of reinforcing bars.

Iron Bars Slow at Chicago

Lack of new business has produced a weakness in the iron bar market locally, and while 1.12½c is quoted on ordinary business, sufficient tonnage of attractive sizes could be placed at 1.10c. Mills are not anxious to take on orders at the latter quotation, and 1.12½c is the lowest figure obtainable unless other conditions make the business unusually desirable.

Sheet Prices Irregular

Competition From Foreign Makers Encountered on the Pacific Coast

Makers of sheets in eastern Pennsylvania who ship considerable tonnage to Pacific coast points have encountered prices by foreign makers in the latter territory of 2.20c at inland destinations for No. 16 gage blue annealed. This price is $2 to $4 a ton below the domestic price of 1.60c, Pittsburgh, plus the all rail or rail and water rates. Orders for quick shipment still furnish eastern sheet makers a fair tonnage and some mills are running full. By far the most of this business is going at 1.55c Philadelphia, or 1.40c, Pittsburgh, for No. 10 gage blue annealed, and cases of $1 less on very attractive orders are exceptional.

Pittsburgh Sheets Lower

The market for steel sheets at Pittsburgh continues weak and irregular. Galvanized products have sold as low as 2.80c for No. 28 gage, and reports of black sheets selling at less than 1.90c for base size are heard. Specifications continue light, and it is apparent some mills are in need of additional tonnage, which accounts for price reductions.

The Cleveland district bottom prices on sheets are still 1.85c, Pittsburgh, for No. 28 black, 2.85c, Pittsburgh, for No. 28 galvanized and 1.40c, Pittsburgh, for No. 10 blue annealed, but very few sales are being made.

At Cincinnati sheets are a little weaker and prices are somewhat uncertain. The general quotation on blue annealed No. 10 gage is 1.50c, Cincinnati, but 1.45c, Cincinnati, can be done under favorable conditions. Black sheets are a little stronger than galvanized, the former being held at 1.95c, Cincinnati, for No. 28 gage, and the latter at from 2.90c to 2.95c, Cincinnati, for the same grade. Transactions are few and usually for small tonnages.

Sheets Still Weak at Chicago

No change in the sheet situation has taken place in the past week and quotations remain at 2.03c to 2.08c and 3.03c to 3.08c, Chicago, for No. 28 gage black and galvanized. Makers see the end of their order book tonnages increasingly near and bidding to obtain tonnage has resulted in these quotations being shaded on numerous occasions. Mills in this district are still operating at fair capacity, but new business is scarce and specifications are not sufficient to keep up with shipments.

The Cameron Mfg. Co., West Haven, Conn., an automobile manufacturer, capitalized at $2,000,000, has been adjudged bankrupt on petition of its creditors. The concern owes about $50,000 to banks and its liabilities total something under $125,000. An attempt will be made to reorganize the company.

(*For Complete Prices See Page* 856)

Scrap Prices Yielding

But Quotations Are Not Often Tested— Dullness Continues

The dull and heavy condition of old material in eastern Pennsylvania is unchanged. Small purchases by consumers and dealers make up the market. None of the large buyers are active. Prices still show some gradual weakness. Some dealers now offer only $10.75, delivered, for heavy melting steel, though a few still will pay $11. A Lebanon buyer having secured some wrought pipe at $10.50, delivered, has gradually dropped his offers to $10, delivered. No. 1 forge stove plate and steel axles are lower.

Market Drifts at New York

The scrap market at New York has not changed its drifting character. There is no pressure either to buy or sell. One New Jersey foundry is reported to have closed for 1,000 tons of heavy cast at between $12 and $12.50, delivered. There is little or no buying of steel. Some wrought pipe has been sold at $10.50, delivered eastern Pennsylvania, and stove plate at $9, delivered Jersey points. Some further small lots of Panama scrap are expected along shortly.

Pittsburgh Scrap Quiet

The market for iron and steel scrap in the Pittsburgh district has been dull, not enough tonnage having been sold to show either strength or weakness. Considerable difference of opinion is expressed as to prevailing market quotations, most of which are nominal. The Pennsylvania railroad is offering material at its several shops in the district.

Market Flat at Buffalo

The Buffalo scrap market is devoid of any semblance of activity. Dealers attribute the lack of inquiry and sales to the general unsettled condition of the whole market situation. All expect a change if the railroads are granted the increases asked for. Prices on the lines in general have been maintained through the period of dullness which has prevailed for some time with the exception of old steel axles, which has sagged $1 a ton; machine turnings, a drop of 25 cents; and a 25-cent decline on both the price of No. 1 and No. 2 busheling scrap.

Quiet at Cleveland

With the Upson Nut Co. embargo still in force, and the Empire and Union rolling mills refusing shipments, the market for iron and steel scrap in the Cleveland district remains dull. No large sales of scrap have been reported. Dealers seem rather reluctant to part with heavy steel at the $10.25 price offered by one consumer. It is thought the Upson embargo may be lifted shortly, which will give the market some impetus. Prices are unchanged.

Flat at Cincinnati

One of the most surprising things in the Cincinnati market is the continued dullness of No. 1 machine cast, which is being quoted at from $10 to $10.50, f. o. b. dealers' yards per net ton. This material is usually the most active in Cincinnati because of the machine tool and foundry business, but demand for it recently has fallen away to a minimum. The market is as flat as is possible for it to be; and prices in numerous cases have grown very uncertain because of the lack of sales to form a test. No changes in quotations are given from those of last week.

Chicago Scrap Holds Advance

Although rolling mill grades of scrap in the Chicago market are slightly weaker than a week ago, the change is principally in sentiment and no alteration in quotations is made. It is believed the short interest in steel scrap has succeeded in covering its requirements and the impetus given prices during the past two weeks is exhausted. However, with lessened offerings from railroads and continued small production of machine shops, scrap quotations of a week ago stand unaltered. Railroads have 7,000 tons now before the market as follows: Chicago & North Western, 4,500, including 1,500 tons of long steel rails; Chicago Great Western, 900 tons; Chicago & Alton, 570 tons, and the Wabash, 875 tons.

The scrap iron market at St. Louis is very dull. Dealers are unable to sell, and are putting the material on their yards. Prices are unchanged from last week. The Missouri Pacific Railroad Co. closed a list today for 2,800 tons; the Mobile & Ohio railroad has one out for 500 tons, and the Wabash one for 1,500, both of which will be closed this week.

The Buffalo Foundry & Machine Co., Buffalo, announces that it has terminated its selling arrangements with H. E. Jacoby, who has been representing this company in New York City and vicinity, and hereafter all inquiries covering vacuum apparatus, castings, patterns and machine work from this territory will be handled direct from the home office of the company at Buffalo.

Billet Market

Is Weaker With Tendency Toward Lower Prices

Pittsburgh and valley manufacturers of billets and sheet bars face a rather discouraging situation. Prices have dropped to levels prevailing the early part of the year. Forging billets are quotable at $25, Pittsburgh, or $1 a ton less than was commanded a short time ago. Wire rods are not quotable above $26, Pittsburgh. Muck bar is nominally listed at $28, Pittsburgh.

Lower Price Predicted

The billet market is not strong and a seller at Cleveland, but not of Cleveland-made billets, expressed the opinion Tuesday that the lowest price which prevailed last December, $19, mill, is likely to prevail again at a not far distant date.

Unchanged at Ashland

The past week has brought no new developments and the market remains quiet and featureless. Prices are unchanged at $21, Ashland, for billets and $26.50, Ashland, for wire rods. Demand is light and limited to filling in for short periods as requirements demand.

Meet Lower Billets in East

Eastern Pennsylvania makers of billets will meet in the Philadelphia and surrounding districts the lower price of $20, Pittsburgh, or $22.40, delivered, now reported from the latter territory. The eastern market at this time, however, is devoid of attractive lots and small requirements only are offered. A fair tonnage of slabs for eastern Pennsylvania delivery was done at some concession.

Alloys Quiet at Pittsburgh

The market for ferro-manganese and ferro-silicon at Pittsburgh continues decidedly dull, and dealers do not expect to enjoy activity for several months. Prices are unchanged.

Light Demand in East

The market for ferro-manganese at New York and eastern districts remains one of small sales and inquiries. Makers' prices are unchanged at $39, seaboard, for English, and $38, seaboard, for German, though occasionally these figures are shaded on carload lots of resale material. Other alloys are inactive.

(For Complete Prices See Page 856)

Slightly Better

In Warehouse Business in New York City and Cincinnati

At Cincinnati the week has opened with prospects of slightly better business. A small demand has sprung up for structurals, and sales on almost all materials carried by local houses are a little more numerous, but they are still comparatively light. Twisted concrete reinforcing bars are selling better, and inquiries are also being received for almost all kinds of building materials. Sheets are slow and unchanged.

Warehouse Business Slow

Continuance of the brick makers' strike is holding up much construction work in Chicago and immediate vicinity and this is having a continued effect on shipments from store. Prices are being maintained fairly well, and while considerable business is current with outside consumers, the slump noted in the city proper is having a decided effect on the volume of warehouse shipments.

Irregularity at Philadelphia

Warehouse buying at Philadelphia is light and competition is keen. Recent transactions in plates, shapes and bars have brought out as low as 1.65c, delivered. Though this is the inside figure, prices are $1 to $2 lower than a few weeks ago.

Little Better at New York

Warehouse business at New York City is running a little better this month than in April, but conditions still are backward for this season of the year. Lower prices and very prompt deliveries offered by eastern mills on plates and bars, have been forcing jobbers to drop their quotations.

Cast Iron Pipes

Orders for the Past Week Are Not Numerous

Apparently the bottom has fallen out of the cast iron pipe market at Chicago. For some unknown reason municipalities apparently are not in the market for their usual requirements, and were it not for contractors' orders for small tonnages, the market would be entirely devoid of business.

Practically no inquiries are before the trade in the west, and with the exception of a possible tonnage at Highland Park, Mich., which is still under consideration, no business is pending. St. Vital, Man., has an inquiry out for 1,000 tons of water pipe, bids on which were to be opened May 6. Makers in this country have no hope of obtaining this tonnage in competition with Canadian foundries, which are not rushed for business at present. The American Cast Iron Pipe Co. was awarded 2,700 tons by the city of Cincinnati, and the United States Cast Iron Pipe & Foundry Co. has taken 78 tons at Pontiac, Mich. Sheffield, Iowa, is taking bids on 79 tons to be awarded this week.

Many Inquiries, Light Tonnage

Inquiries for cast iron pipe in New York City and surrounding territory still are very numerous, but the tonnage involved is not large. Prices still develop some low spots where competition is keen. Some eastern foundries continue to name down to $19 to $19.50, at the plant, for 6 to 8-inch pipe. Bids will be taken May 12 by the board of water supply, New York, on about 1,700 tons of 48-inch pipe for a portion of the Catskill aqueduct in the borough of Richmond. Pompton Lakes, N. J., is taking figures on 690 tons of 4, 6, 8 and 10's.

Boiler Tubes

Are Reduced $2 Per Ton—Oil Well Casing

The National Tube Co., on May 1, issued new steel boiler tube cards, increasing discounts one point, which is equivalent to a reduction of $2 a ton in price; other manufactures followed. Iron boiler tubes are unchanged.

Casing Reduced at Pittsburgh

The National Tube Co., Pittsburgh, on May 1, sent out new cards, showing a reduction of about $1 a ton in the price of oil well casing and 2-inch line pipe, but tubing and drive pipe, unaffected by the advance of Feb. 2, were not changed. Reductions followed those of April 20 on standard steel pipe and line pipe. Manufacturers now are offering the same prices in effect the early part of the year. No large orders have been taken since last week.

Tin Plate Mills Busy

Manufacturers of tin plate in the Pittsburgh district are operating plants at practically full capacity, and similar conditions prevail in other sections of the country. Some new inquiry has come out, and there is greater tendency to maintain prices than a month ago.

The Mead Gas Heater Co., Passaic, N. J., has been incorporated to manufacture heaters; $80,000; by Jacob A. Troast, Charles F. H. Johnson, Frederick W. Gaston, Passaic.

Plate Market

Continues Very Quiet and Sales Are Small

The Philadelphia plate market remains very quiet and sales are small in size, as buyers show no interest in placing tonnage lots. As far as shown by the present run of business, base prices seem uniform at 1.30c, Philadelphia, or 1.15c, Pittsburgh, though there are reports that some mills are not insisting upon full differentials between grades. At farther westward plants, eastern Pennsylvania plate makers have encountered instances where 1.15c, Pittsburgh, has been sharply shaded, presumably by certain western Pennsylvania mills.

Several manufacturers in the Pittsburgh district say specifications for plates last week were somewhat heavier, but new buying continues light and prices still are irregular. Plates are being held at 1.15c, but reports of that figure being shaded are heard, and some mills, rolling limited sizes, are understood to have openly quoted below the general market.

Stationary at Cincinnati

Sheared plates are being held at 1.45c, Cincinnati, by mills in this territory, but very little business is being placed. Demand is mostly for small lots for early delivery.

Elevated Railroad Plates Placed

At New York, the Cambria Steel Co., it is understood, will furnish 2,200 tons of plates to an eastern fabricator for a section of elevated work. The Jones & Laughlin Steel Co. also is reported to have closed with another fabricator for a round tonnage of plates and shapes for another section. The regular price on plates at New York remains 1.31c, or 1.15c, Pittsburgh, but on attractive orders this has been shaded $1. The market is quiet.

Wire Business

Shows Some Improvement in the Chicago District

Wire business in the Chicago district has shown some improvement recently and hopes are entertained that the situation may continue to show better indications.

Although better specifications have come out in some territories, manufacturers of wire products in the Pittsburgh district do not regard the situation as a satisfactory one. There appears to be no uniform attempt to maintain prices, reports of shading being heard in several instances. Jobbers' stocks are low, and attempts are being made to replenish them at prices prevailing early this year.

(*For Complete Prices See Page* 856)

Structurals Are Brisker

In the Chicago District—Very Lively Competition in New York City

Bookings of structural steel in the Chicago district recently include eight projects, all but one of which are for small tonnages and widely scattered over the west. The pier house for the city of Chicago has not been awarded and it cannot be determined yet who will fabricate the steel. This involves about 6,500 tons.

The largest project closed the past week is the Muehlebach hotel at Kansas City, which has been before the market for about six weeks. This involves about 2,000 tons.

Keen Competition at New York

New York City and vicinity still presents a large pending tonnage of structural requirements for miscellaneous work, of which about 30,000 tons are for subway and elevated railroad construction. The disposition of buyers to move slowly, however, in making awards, still is pronounced. Lettings of the week have been light, totaling less than 4,000 tons. There is keen competition for plain material among both eastern and western Pennsylvania makers in the metropolitan district and 1.26c, New York, or 1.10c, Pittsburgh, is coming out on the larger orders. An order for about 3,000 tons of shapes for elevated railroad construction was placed with an eastern mill at practically this figure.

Building at Cleveland

Although the report of the building department of the city of Cleveland for April shows a total of building permits of $2,594,115, making the largest April record in the past five years, and exceeding April of 1913 by $714,030, the demand for structural steel is very light and only a fair tonnage of reinforcing bars is being used. This condition is accounted for by the fact that the new building in Cleveland at present is confined, to a very large extent, to the erection of homes and apartments. Very few factory buildings are being erected.

Pittsburgh Shapes Unchanged

Structural shapes are listed at a range from 1.15c to 1.20c at Pittsburgh, manufacturers in that district being able to obtain the maximum figure when small tonnages are involved. Inquiry for structural material is fairly heavy, but not many attractive orders have been taken this week.

Structural shapes in the Chicago market are quoted at 1.30c to 1.35c, Chicago, but there is little strength in the market, and while shading of this quotation is not evident, some pending tonnage is expected to come out somewhat lower. Business in structural shapes is unusually light, and while some improvement in tonnage has been noted, it has not been sufficient up to this time to carry prices to a higher level. In fact, mills are decidedly hungry for tonnage, and until a number of large projects are undertaken, makers will not find their books sufficiently filled to advance prices.

Further evidence has appeared at Philadelphia and vicinity that at least one eastern maker is naming 1.25c, Philadelphia, or 1.10c, Pittsburgh, on ordinary lots of structural shapes, while it is indicated several other mills would do this price on a very attractive order. The lowest prices represent about 1.20c, eastern Pennsylvania mill. Eastern makers generally report new business is light, though some of them have improved their forward position through a fair tonnage recently taken. The Eastern Steel Co. will furnish about 3,000 tons to L. F. Shoemaker & Co., for the New York elevated railroad section which the latter will fabricate.

Structural Leads at Buffalo

The moderate volume of inquiry and placement in the Buffalo market for material from the mills and agencies is led by structural. No particularly large tonnages are being placed, but the total of the small demands from numerous construction undertakings represents in the aggregate a good tonnage. Some buyers are seeking to obtain better than 1.15c, base, but that is held to be the minimum. In some instances 1.20c, base, is being obtained, but less of the latter is being secured on small tonnages than was the case last week.

CONTRACTS AWARDED.

Muehlebach hotel, Kansas City, Mo., 2,000 tons, to the Kansas City Structural Steel Co., Kansas City, Mo.

Powers building, Decatur, Ill., 550 tons, to the Decatur Bridge Co., Decatur, Ill.

Lake County, Ind., six highway spans, 379 tons.

Humboldt County, Cal., three 165-foot highway spans, 357 tons, to the American Bridge Co.

A. T. & S. F. Ry. Co., metal work for passenger station, San Diego, Cal., 348 tons, to the American Bridge Co.

Eastern Concrete Steel Co., Buffalo, contract, 250 tons reinforcing bars, new Con-

St. Patricks Church, San Francisco, Cal., 300 tons, to the California Construction Co., who will purchase the material from McClintic-Marshall Construction Co.

Three pin-connected highway spans, Sartell, Minn., 222 tons, to the Minneapolis Steel & Machinery Co.

Haw-Simmons Hardware Co., Ottumwa, Ia., four story building, Ottumwa, Ia., 219 tons.

Cramp & Co., New York City, secured general contract, Ward & Ward, Inc., new baking plant, Buffalo, taking 700 tons reinforeign bars, small tonnage structural.

necting Terminal Elevator, Buffalo.

Lackawanna Steel Co., secured contract 280 tons plain flats and rounds, Connecting Terminal Elevator, Buffalo.

Buffalo Structural Steel Co., Buffalo, 500 tons structural, Connecting Terminal Elevator, Buffalo.

Pittsburgh Screw & Bolt Co., Pittsburgh, contract, 180 tons stay and screw bolts, for guide piers, U. S. ship lock, Black Rock harbor, Buffalo, N. Y.

Buffalo Structural Steel Co., Buffalo, contract 975 tons steel, Poppenberg store and loft building, Buffalo.

Railroad bridge at Lorain, Ohio, 300 tons, awarded to the American Bridge Co.

Allegheny Coke Co., coal bin at Hellier, Ky., 200 tons, awarded Jones & Laughlin Steel Co.

Warehouse for Morgan Millwork Co., Baltimore, 350 tons, awarded to Laues & Hooper.

Loft building for Concourse Corporation at Fifty-fifth street and Vanderbilt avenue, New York City, 2,600 tons, awarded Hay Foundry & Iron Works.

Highway bridge near Baltimore, 250 tons, awarded Phoenix Bridge Co.

Loft building, 15 East Forty-fourth street, New York City, 500 tons, relet to the Passaic Structural Steel Co. This contract originally was placed with Ravitch Bros.

CONTRACTS PENDING.

The United States government, early next week, will open bids on a transport and a supply ship, involving 3,500 and 2,500 tons, respectively.

Masonic temple, Toronto, taking bids on 350 tons structural.

Consolidated Milling Co., Inc., Buffalo, new grain elevator, feed mill and dry house, bids go in this week, taking 250 tons reinforcing bars.

Hardware building, Atlanta, Ga., 600 to 800 tons of concrete bars; alternate bids on steel construction also asked.

Bridge across the Ohio river at Portsmouth, O., for Chesapeake & Ohio railroad, estimated to require 10,000 tons or more; revised plans about to be issued.

Addition of the Fire Stone Rubber Co. Akron, 700 tons.

Piershed for Hamburg-American Steamship Co., North river, New York City, 350 tons, R. P. & J. H. Staats, awarded general contract.

Bridge Contracts.—The county commissioners of Butler county, O., have let the contract for the rebuilding of the High street bridge, at Hamilton, to the A. Y. Yawger Co., of Indianapolis, at its bid of $142,440. These same commissioners have also let the contract for the Middletown bridge at Middletown, O., to the Hackedorn Construction Co., of Indianapolis, at its bid of $225,000. Both of these bridges were destroyed by the floods of March, 1913.

(*For Complete Prices See Page* 856)

Railroad Buying Livelier

In the Chicago District—Buying Rails and Track Fastenings More Briskly

New York, May 6. (By wire.)—The Erie railroad has closed for 14,000 tons of rails. Of this amount 12,000 tons go to the Carnegie Steel Co. and 2,000 tons to the Illinois Steel Co. The St. Paul railroad places 2,000 tons additional with the Illinois Steel Co., and miscellaneous orders amounting to 3,000 to 4,000 tons have been closed.

Railroads Buy Better at Chicago

Makers of railway supplies, rails and track fastenings find in the past 10 days a tendency toward better conditions, which fact is lending some encouragement to the situation. Orders for rails and track accessories have been moving more briskly, though for small lots. Specifications in many quarters are improving sufficiently to be noticeable and deferred tonnages are being released to the mills. It appears to mill men that railroads are reaching the point where stocks are exhausted and it is necessary to enter the market for more or less material in order to continue operation.

One feature of the steel market since last fall has been the fear that tonnage was being piled up in orders held back and that it might be dumped on the market with a rush, clogging mills and shipping facilities. That it appears to be loosening slightly with indications for somewhat heavier orders immediately following is something of a relief which it is hoped will be realized.

One interest represented in the Chicago market finds the month opening with considerable more vigor than was seen during April, and with fair prospects in view, hopes the month may prove the best so far this year.

Car Orders for April

Orders for cars placed by the railroads during the month of April totaled about 8,000, bringing the purchases of the four months of the year to date to 37,500. About 3,500 of these cars were placed direct with railroad shops. During a similar period in 1913, a total of 72,500 cars was ordered. Orders placed by months during the current year to date, according to carefully compiled statistics, have been approximately as follows: January, 13,000; February, 9,000; March, 7,500, and April 8,000. At present, the car market is inactive.

Reported rail orders in April were the smallest of the year to date and totaled only 60,000 tons, compared with 175,000 in January, 215,000 tons in February and 61,500 tons in March. The rail market at present is dull but some tonnage for eastern lines is under negotiation in New York. The Pennsylvania Steel Co. has taken 1,800 tons of girder rails for a middle western road.

CAR AND LOCOMOTIVE ORDERS.

The Rutland railroad has ordered four coaches from the American Car & Foundry Co. and three or four steel coaches from the Standard Steel Car Co.

The Lehigh & New England railroad has placed 9 cabooses with the American Car & Foundry Co.

The Bethlehem Steel Co. is inquiring for 50 ore cars.

The Death Valley Railroad Co. has ordered one consolidation locomotive from the Baldwin Locomotive Works.

The Maryland and Pennsylvania railroad has ordered two consolidation locomotives from the Baldwin Locomotive Works.

The Phoenix Sand & Gravel Co. has placed one four-wheel saddle tank locomotive with the American Locomotive Co.

The Alabama Great Southern railway has ordered one superheater Mikado freight locomotive from the American Locomotive Co.

The Butte, Anaconda & Pacific railway has ordered four 80-ton electric locomotives and three electric trailers from the General Electric Co. The American Locomotive Co. will furnish the mechanical equipment for the electric locomotives and the trucks for the trailers.

Very Little Speculative Buying

New York, May 6. (By wire.)—Though fabricating prices are low, they are not stimulating the usual amount of speculative buying and building work is not up to the scale naturally expected at this season. The American Bridge Co. has taken 3,500 tons for the Bell Telephone building, Pittsburgh, and 3,000 tons for additions to the American Brass Co.'s plant at Torrington, Conn.

Sewer Contracts Let

Detroit, May 6. (By wire.)—Contracts for the Highland Park sewers have been let by council to the William Blanck Co., of Highland Park, and Jones & McRoberts, Pittsburgh, for $77,566. Blanck bid $39,005; Jones & McRoberts bid $38,561. The Blanck company does the work in Oakland avenue and Jones & McRoberts in Hamilton avenue, work covering approximately 6 miles.

(*For Complete Prices See Page* 856)

METAL MARKETS

New York

May 5.

Tin.—The price of tin today, following a downward movement which has continued since the latter part of March, is lower than at any time since the summer of 1910. June sold today at 33.20c, July at 33.35c, and August at 33.45c, and these prices represent the market fairly. Spot and May may be quoted anywhere from 33c to 33.12½c. In London, today's close was £150 10s on spot and £152 10s on three months, a new low record for the year and the lowest quotations since 1910. The close was weak both in London and New York.

Deliveries of tin in this country during April were good, totaling 4,300 tons. The world's visible supply at the end of April was 15,447 tons, which showed a decrease of 1,542 tons from the end of March, but which was 5,625 tons in excess of the visible as of April 30, 1913.

Copper.—The refined copper market is dull, both here and abroad. Electrolytic may be quoted at 14.25c to 14.37½c, delivered 30 days, or about 14.10c to 14.20c, cash. Casting may be quoted at 14c, cash. Prime lake is quoted at 14.50c, cash, and a 14.50c, delivered 30 days, quotation also may be secured in special cases.

Exports of copper totalled 34,787 tons during April. This compared with 46,504 tons in March and 33,274 tons in April of last year. The total for the first four months of this year exceeds the exports during the corresponding period of 1913, by 24,423 tons.

Lead. — Independent lead producers are showing a willingness to meet the leading interest's New York shipment price and the market thus may be quoted at 3.90c, New York, for carload lots.

Spelter. — Considerable business was done last week at the reduced prices but demand now has slackened off. The market may be quoted at 5c to 5.05c, New York, for prime western brands in carload lots.

Antimony. — The antimony market continues dull with prices unchanged from last week.

Chicago

May 4.

Little change is apparent in new metals, spelter showing somewhat weaker than last week and with reports of large stocks in the hands of smelters the reaction in price seems to be far distant. Other metals have shown comparatively little change.

We quote dealers' selling prices f. o. b. Chicago, as follows:

Lake copper, carload lots, 14.25c; casting, 14.25c; smaller lots, ¼c to ¾c higher. Spelter, car lots, 4.90c; lead, desilverized, 3.80c; sheet zinc, $7.00, f. o. b. La Salle, in car lots of 600-pound casks; pig tin, 34.50c; Cookson's antimony, 7½c; other grades, 6c.

Old metals remain unusually quiet with no activity in any department. Following weakness in new metals the various scrap products fail to regain lost ground. Stocks on hand with dealers and consumers appear to be too large for the demand to overcome.

We quote dealers' selling prices f. o. b. Chicago, as follows:

Copper wire, crucible shapes, 13.75c; copper bottoms, 12.00c; heavy red brass, 12.50c; heavy yellow brass, 9.25c; No. 1 red brass borings, 11.00c; No. 1 yellow brass borings, 8.25c; brass clippings, 9.50c; lead pipe, 3.60c; zinc scrap, 4.00c; tea lead, 3.50c; No. 1 aluminum, 14.00c; No. 1 pewter, 23.50c; block tin pipe, 32½c; tin foil, 29.00c; linotype dross 3c; electrotype dross, 3c; stereotype plates, 4.25c; stereotype dross, 3c.

Pig Iron Production is Smaller

April Output Shows Only Slight Decline From March But Large Number of Blast Furnaces Were Blown Out in Last Week

While pig iron production in April showed only a small decline, there were 20 less stacks in blast on April 30 than on the last day of March. Of these furnaces, now idle, more than half were blown out during the last week of April, so that their influence on the month's total output was comparatively small, but will be felt more seriously during the present month.

The total output of coke and anthracite pig iron in April was 2,261,501 tons, compared with 2,341,551 tons in March, a loss of 80,050 tons. This decline was

MONTHLY PRODUCTION.

	1914.	1913.	1912.
January	1,879,336	2,787,800	2,052,806
February	1,888,607	2,578,670	2,098,796
March	2,341,551	2,762,823	2,411,529
April	2,261,501	2,754,353	2,377,621
May	.....	2,816,825	2,503,341
June	.....	2,616,883	2,433,737
July	.....	2,558,275	2,402,567
August	.....	2,537,018	2,500,163
September	.....	2,494,098	2,444,454
October	.....	2,539,924	2,683,645
November	.....	2,229,960	2,639,562
December	.....	1,976,138	2,777,292
Totals	8,370,995	30,652,767	29,325,513

ascribable largely to the shorter month, as the decline in average daily production was only 151 tons. The average output in April was 75,383 tons against 75,534 tons in March.

The merchant furnaces showed the greater decline in output. The output of merchant iron in April was 609,783 tons, compared with 659,514 tons in March, a loss of 49,731 tons. In average daily output, the merchant furnaces showed a decline of 949 tons, av-

AVERAGE DAILY PRODUCTION.

	1914.	1913.	1912.
January	60,624	89,929	66,220
February	67,450	92,095	72,372
March	75,534	89,123	77,791
April	75,383	91,812	79,254
May	.....	90,865	80,753
June	.....	87,229	81,125
July	.....	82,525	77,502
August	.....	81,839	80,650
September	.....	83,137	81,482
October	.....	81,933	86,569
November	.....	74,322	87,985
December	.....	63,746	89,590

erage production for April being 20,326 tons and for March 21,275 tons.

The small influence exerted by the large number of stacks going out of blast, is more clearly shown by the figures for production of the steel works or non-merchant furnaces. While there was a loss of 16 in active steel works stacks, the average daily output showed a gain. Production of steel-making iron in April was 1,629,234 tons against 1,657,720 tons in March, a loss of 28,486 tons. In daily average, the figure for April was 54,308 tons and for March 53,475 tons, a gain of 833 tons.

There were 232 stacks active on March 31 and 212 on April 30. Three merchant furnaces were blown in and seven blown out, a net loss of four. Sixteen steel works stacks were put out and none relighted. In all, three stacks were relighted and 23 blown out.

Ferro output in April was 17,400 tons, compared with 11,707 tons in March, a gain of 5,693 tons. The production of spiegel in April was 5,084 tons and in March 12,610 tons, a loss of 7,526 tons.

Among merchant furnaces blown out were: Woodward No. 2, Woodward Iron Co., April 13, for relining; Toledo "B", Pickands, Mather & Co., April 4; Fannie, M. A. Hanna & Co.; Shenango No. 1, Shenango Furnace Co., April 11; Lock Ridge No. 7, Thomas Iron Co., April 11, and Cranberry, Cranberry Furnace Co., April 26.

Merchant furnaces resuming were: Hattie Ensley, Sloss-Sheffield Steel & Iron Co., April 25; Bessemer No. 4, Tennessee Coal, Iron & Railroad Co., April 1, and Cleveland No. 1, Cleveland Furnace Co., April 4.

Steel works furnaces blown out were: Emma and one Shoenberger, American Steel & Wire Co.; one Ohio, April 28; one Mingo, April 14; one Edgar Thomson, April 6; one Duquesne, April 7; one Duquesne, April 27; one Carrie, April 16, and one Farrell, April 29, of the Carnegie Steel Co.; Lorain No. 5, April 30; Monongahela No. 3, April 30; Riverside No. 2, April 29, and Riverside No. 1, April 30, National Tube Co.; one Bethlehem, Bethlehem Steel Co., April 29; one Aliquippa, Jones & Laughlin Steel Co., and Hall, Republic Iron & Steel Co., April 29.

The Carbon Iron & Steel Co., Ltd., banked its Carbon stack on April 19, Temple, of the Temple Iron Co., is expected to go out of blast this month.

The Thomas Iron Co. abandoned its Hokendauqua No. 5 furnace during April, while Andover, of the Andover Iron Co., was sold and probably will be dismantled.

Students in the engineering departments at Ohio State University, Columbus, O., visited plants in the Pittsburgh district last week. Plants of the Union Switch & Signal Co., the National Tube Co. and the Westinghouse Electric & Mfg. Co. were inspected. Students left Columbus April 26 and visited industries at Cleveland, Buffalo, Niagara Falls and Ontario,

APRIL PIG IRON.

States.	No. of stacks.	No. in blast last day of month.		Total tonnage made.		Totals	
		April.	March.	Merchant.	Non-Merchant.	April.	March.
Pennsylvania	157	83	97	156,622	781,356	937,978	979,054
Ohio	73	47	51	126,658	404,616	531,274	547,865
Alabama	45	18	17	107,186	35,799	142,985	159,879
Virginia	22	7	7	24,461	.....	24,461	30,134
New York	26	15	15	76,701	64,346	141,047	134,206
New Jersey	7	2	2	10,868	.....	10,868	9,997
Illinois	26	14	14	29,986	155,842	185,828	191,186
Colorado	6	2	2				
Indiana	10	8	8				
Maryland	4	2	2				
Wisconsin	6	4	4	29,707	162,172	191,879	189,402
Kentucky	7	2	2				
West Virginia	4	1	3				
Tennessee	18	4	5				
Washington	1	0	0	24,564	25,103	49,667	50,369
Georgia	2	0	0				
Texas	3	0	0				
Minnesota	1	1	1				
Michigan	3	2	2				
Missouri	1	0	0	23,030	.....	23,030	23,142
Spiegel—All states...						5,084	12,610
Ferro—All states....						17,400	11,707
Totals	422	212	232	609,783	1,629,234	2,261,501	2,341,551

Increase Capital Stock

Stockholders of the Youngstown Iron & Steel Co., Youngstown, O., John O. Pew, president, at a meeting April 29, voted to increase the company's capital stock from $1,200,000 to $3,000,000. It had been the original intention to increase the stock only to $2,400,000. The increase is for the purpose of erecting four 75-ton open-hearth furnaces and adding to the working capital of the company.

Testify About Agreements

Witnesses at American Can Hearing Tell of Contracts Made at Sale

Government counsel in the suit for the dissolution of the American Can Co. has taken considerable oral testimony recently in an effort to support the contention that the Can company endeavored to keep down the number of its competitors. A number of owners of the plants which went into the Can company at the time of its organization were called.

One witness, Louis McDonald, formerly of the Mersereau Mfg. Co., which went into the Can company, said the original price set for the purchase of the Mersereau concern was $300,000. When asked to sign an agreement that he would stay out of the business for 15 years, Mr. McDonald refused to sell. So important did the Can company organizers consider this agreement, he said, that they finally raised the price to $700,000, and at this figure the Mersereau owners waived their objections to signing the agreement.

Charles Prescott Poole, who owned A. C. P. Poole & Co., Philadelphia, which went into the Can company, told about entering into such an agreement. In 1903, he said, he took this agreement to his counsel, who told him it was in restraint of trade and, consequently, illegal. In 1904, therefore, Mr. Poole went into the business in Philadelphia as the A. G. R. Hocker Co. He said in 1913 he paid $3.60 for tin plate, per 100 pounds of 14 x 20, while this year he is paying $3.40. Most of this tin plate is purchased from the American Sheet & Tin Plate Co. The only discount he gets, said Mr. Poole, is 2 per cent off for cash.

Several witnesses were called to the stand to give testimony to the effect that the American Can Co., for several years after its organization, by means of contracts which it had with machinery manufacturers, made it almost impossible for independent manufacturers to get efficient can machinery. Howard C. Seaman, secretary and treasurer of the E. W. Bliss Co., Brooklyn, N. Y., Enos Paullin, secretary and treasurer of the Ferracute Machine Co., Bridgeton, N. J., and Benjamin Adriance, of the Adriance Machine Works, Brooklyn, N. Y., told about contracts which they entered into with the Can company in 1901. These were for periods of six years and were not renewed in 1907.

Harry L. Hudson, a Brooklyn tin box manufacturer, on being called to the stand, said that in January, 1907, he tried to get quotations on automatic edging machines and automatic square double seamers from the Bliss and Adriance companies, but these concerns refused to quote, saying they were tied up in such a way that they could not fill any orders. Alfred E. Bruns, secretary and general manager of the Metal Package Co., Brooklyn, testified that he was stenographer at the American Stopper Co., when the latter was taken into the Can company, in 1905, and that the latter, on assuming ownership, immediately installed automatic machinery which the American Stopper Co., as an independent, previously had been unable to buy.

The hearings now are being held about once or twice a week at the post office building, Brooklyn.

Longmead Works Sold

The plant of the Longmead Iron Works, Conshohocken, Pa., has been sold in parcels at public sale by the receivers. A number of second-hand machinery and old material dealers were awarded portions of the property and the total amount realized from the sale was about $21,500. The plant consisted of puddling and heating furnaces, four trains of rolls and other equipment. The real estate was not sold.

Long on One Lining

Midland furnace, at Midland, Pa., owned by the Pittsburgh Crucible Co., has gone out of blast after operating eight and one-half years on one lining. The stack, running on basic, had been producing about 14,000 tons a month. Owners expect to apply the torch again in 60 days.

Change to Eastern Time

The city of Cleveland adopted eastern time May 1. Nearly all the manufacturing companies moved their clocks forward one hour. Very little confusion was reported and the outlook is that the plan to give everybody one hour more of daylight will prove satisfactory. Youngstown and a number of smaller Ohio cities have also adopted eastern time. The railroads at Cleveland with the exception of the Erie and the Wheeling & Lake Erie, are still running on standard time and some passengers are finding themselves at the Union depot an hour ahead of time.

Better Feeling

But Solid Foundation is Still Lacking

New York, May 6. (By wire.)—Some further expressions of brighter sentiment in the steel situation are being made, notably from the Chicago district, but there still is lacking the tangible ground of increased volume for such feelings. There is little change in the mental attitude of buyers and there remains indifference to factors which ordinarily stimulate. New business with some large makers is about up to the level of the past two months, but unusual efforts are required to get orders. Tube business in April equaled that of March, and May and June are expected to be as good. Wire specifications are very satisfactory.

Corporation Plant Activities

New York, May 6. (By wire.)—The United States Steel Corporation's operations show only a slight change in the past two weeks. At present, the ingot capacity active runs from 65 to 70 per cent. A few plants are doing better than 70 per cent.

Will Buy Cars

New York, May 6 (By wire.)—The Lackawanna railroad has issued an inquiry for 500 hoppers. The Illinois Central is about to distribute 3,000.

Coke Workers Wages Reduced

The Connellsville Central Coke Co., Pittsburgh, operating about 500 ovens in the lower Connellsville regions, announced a wage reduction of approximately 7 per cent, May 1, going back to the scale in effect in 1911. Owners of some coke plants, it will be recalled, adopted the 1911 scale early this year, but the majority of plants have not taken any action in this respect. The Connellsville Central company, it is stated, decided to reduce wages when the Pittsburgh Crucible Steel Co. blew out its blast furnace at Midland, Pa., but expected to return to the higher scale as soon as the stack resumed.

Iron Ore Prices Sharply Reduced

By Restoration of 1912 Schedule—No Activity Aroused, as Furnaces Are Well Supplied With Ore

In the great struggle to protect American markets against foreign invasion by iron and steel products under the Underwood law, sellers of Lake Superior iron ores will do their part in keeping down costs of producing pig iron. The naming, on May 1, of the very low prices of 1912 for ore to be delivered in 1914 will place the cost of manufacturing pig iron on a low basis and will in time—if the blast furnace owners do not give away all the advantages of lower prices—check the losses which the statistics collected by the American Pig Iron Association demonstrate are being sustained by them.

A considerable number of mines will undoubtedly remain idle this year, as they cannot be operated except at a heavy loss at the 1912 prices, but there will be plenty of ore mined to meet the demands of all consumers. Some users of iron ore who have large stocks on hand would certainly have welcomed higher prices for ore, but from week to week there was more positive evidence that a large majority of the merchant furnaces strongly desired lower prices than those of 1913.

Once more the unexpected happened in regard to prices of Lake Superior iron ore. Owing to the extreme dullness of the market for pig iron and finished products, it seemed probable that this year the time for the fixing of prices would be fully as late as has ever been recorded in the history of the ore trade, the latest date being that of June 15, 1908, but, to the surprise of the trade, it was announced last Friday by some interests that the prices of 1912 would be made for this year. Other selling companies assented and it is now generally agreed that the 1912 prices will prevail this year. The 1912 prices were lower than any that had been named since 1904. The 1912 and 1914 prices are: Old range Bessemer, $3.75; Mesabi Bessemer, $3.50; old range non-Bessemer, $3, and Mesabi non-Bessemer, $2.85 a ton, at Lake Erie ports. Compared with prices obtained for 1913 shipment, this year's quotations show the following reductions: Old range Bessemer, 65c; Mesabi Bessemer, 65c; old range non-Bessemer, 60c, and Mesabi non-Bessemer, 55c a ton.

In 1911, the selling of ore was participated on April 21 by the receipt of a telegram to THE IRON TRADE REVIEW, stating that the W. P. Snyder interest of Pittsburgh had sold 550,000 tons at a reduction of 50 cents from the prices of 1910, in which year also Mr. Snyder had fixed the prices. In March, 1912, the activity of Mr. Snyder hastened the opening of the market, but the first sales were made by Pickands, Mather & Co., who also opened the market for 1913 on Nov. 19, 1912, by the sales of several million tons. This year, salesmen from ore companies found it impossible to interest buyers without being able to name prices. Furnace men asserted that in selling pig iron, they had to name prices, and that the ore sellers ought also to give quotations. Very reluctantly, the ore sellers came to the conclusion that it would be necessary to again name the very low prices of 1912. The action has not been followed by any activity in the market. Many furnaces are so well supplied with ore at the present time that they see no occasion for buying additional supplies.

The buying season for 1907 was the earliest on record, as it started on Nov. 2, 1906, and within a week practically all the ores for sale had been disposed of. Next to the early buying movement for the year 1907, came the buying for delivery of 1906, with Dec. 5, 1905, as the date of the buying movement, and 1890 and 1900, each with Dec. 15 of the previous years as the date of the buying movement. Four years—1899, 1905, 1909 and 1912—were characterized by two buying movements. The year 1908 will always be remembered on account of the refusal of the buyers to accept the prices named in February of that year. Contrary to the judgment of some of the wisest men in the ore trade, the 1907 prices were reaffirmed for 1908. This action followed the panic of 1907. Owing to furnaces refusing to place their orders, prices were reduced 50 cents per ton on June 15, 1908. The buying movement which then started was the latest on record. In 1909, many reservations were made during the early months and there was a little buying, but prices were not determined until May 10, 1909. In 1910, all the Bessemer ore available was reserved before prices were established and reservations were quickly turned into actual sales when prices were announced. Some non-Bessemer ore was also sold early, but sales of the remaining tonnage dragged throughout the year. In 1912, the ore market moved slowly at the beginning, but the ore was rapidly disposed of during the spring and early summer, after the improvement in business got well under way. The second buying

SELLING PRICE OF IRON ORE AND PRICE OF PIG IRON AT DATE OF BUYING MOVEMENT 1890-1914

Season.	Date buying movement.	—Season Iron Ore Prices— Old range Bessemer.	Mesabi Bessemer.	Old range non-Bessemer.	Mesabi non-Bessemer.	—Iron Prices— Valley Foundry Bersemer.	Iron No. 2.
1890.....	Dec. 15, 1889.....	$5.50	no sale	$5.25	no sale	$22.15	$18.15
1891.....	June 1, 1891.....	4.50	no sale	4.25	no sale	15.15	15.00
1892.....	Jan. 31, 1892.....	4.50	no sale	3.65	no sale	15.00	13.65
1893.....	Mar. 15, 1893.....	3.85	$3.00	3.20	no sale	12.65	12.15
1894.....	Mar. 1, 1894.....	2.75	2.35	2.50	no sale	9.65	9.65
1895.....	April 1, 1895.....	2.90	2.19	2.25	$1.90	9.40	9.40
1896.....	May 1, 1896.....	4.00	3.50	2.70	2.25	12.40	11.15
1897.....	May 20, 1897.....	2.60	2.25	2.15	1.90	8.35	8.40
1898.....	Mar. 20, 1898.....	2.75	2.25	1.85	1.75	9.55	9.80
1899.....	Feb. 1, 1899.....	3.00	2.40	2.15	2.00	10.30	9.75
1900.....	Dec. 15, 1899.....	5.50	4.50	4.25	4.00	24.15	22.15
1901.....	April 15, 1901.....	4.25	3.25	3.00	2.75	16.15	14.40
1902.....	Feb. 1, 1902.....	4.25	3.25	3.25	2.75	15.90	15.90
1903.....	Mar. 20, 1903.....	4.50	4.00	3.60	3.20	21.50	21.65
1904.....	Apr. 15, 1904.....	3.25	3.00	2.75	2.50	13.35	13.15
1905.....	Feb. 1, 1905.....	3.75	3.50	3.20	3.00	15.50	16.00
1906.....	Dec. 5, 1905.....	4.25	4.00	3.70	3.50	17.25	17.25
1907.....	Nov. 5, 1906.....	5.00	4.75	4.20	4.00	21.50	21.50
1908.....	June 15, 1908.....	4.50	4.25	3.70	3.50	16.00	15.00
1909.....	May 10, 1909.....	4.50	4.25	3.70	3.50	14.75	14.25
1910.....	Dec. 24, 1909.....	5.00	4.75	4.20	4.00	19.00	17.25
1911.....	Apr. 21, 1911.....	4.50	4.25	3.70	3.50	15.00	13.75
1912.....	Mar. 20, 1912.....	3.75	3.50	3.00	2.85	14.25	13.25
1913.....	Nov. 19, 1912.....	4.40	4.15	3.60	3.40	17.25	17.50
1914.....	May 1, 1914.....	3.75	3.50	3.00	2.85	14.00	13.25

movement of the year 1912, that for 1913 delivery, started with heavy reservations of steel companies being converted into contracts, but the merchant furnaces moved slowly and the market dragged throughout the year at its height. The idea, which was first embodied in chart form in our issue of Feb. 21, 1907, is to establish in a graphic manner the relation of the raw material price to that of pig iron. During the past years up to were fixed, the lines for both pig iron and ore had an upward tendency, but later, in 1910, pig iron started downward and continued to decline throughout the year, the decline in Bessemer being $4.

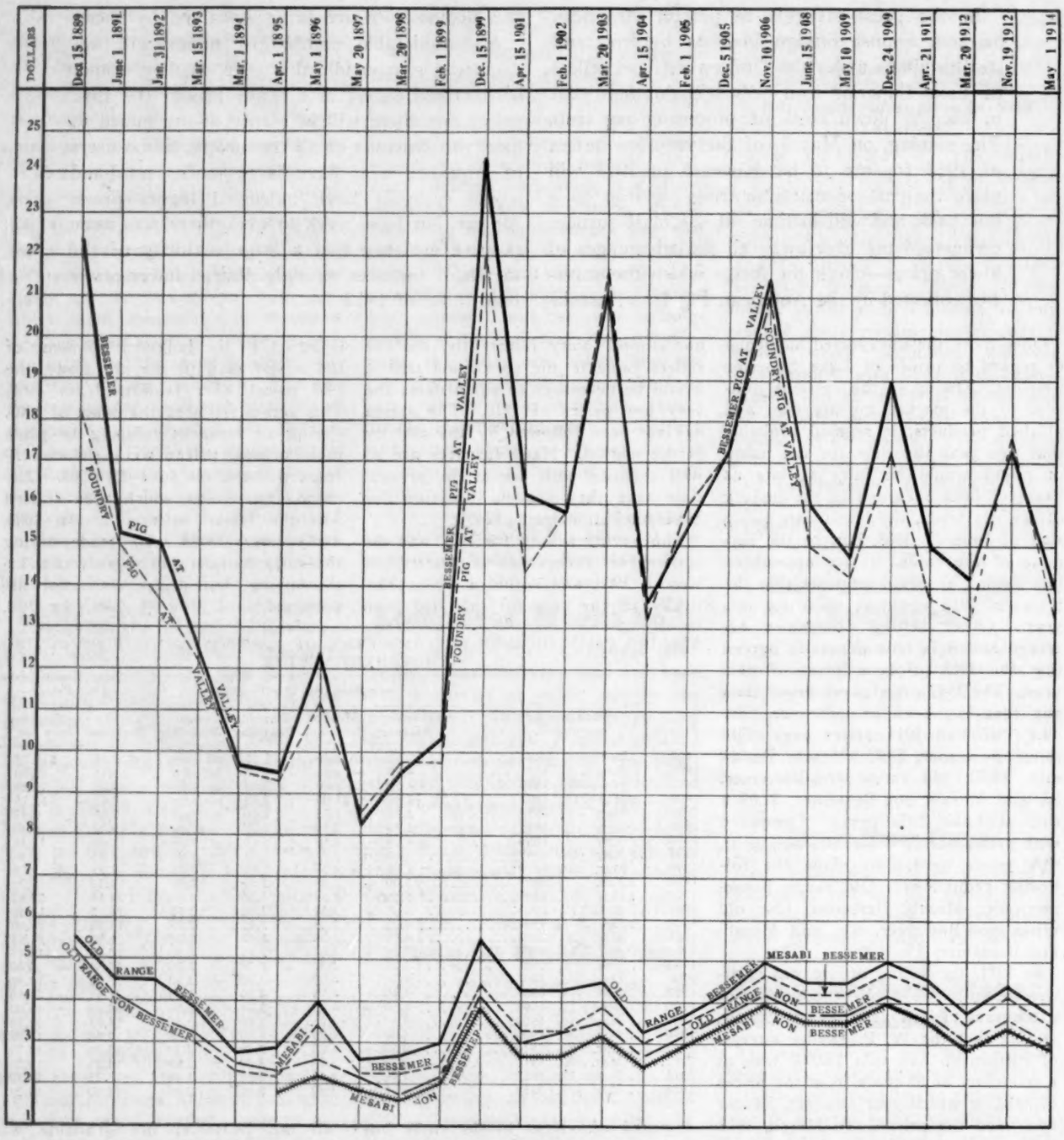


CHART 1—PRICE FLUCTUATIONS OF IRON ORE, BESSEMER AND FOUNDRY PIG IRON, PER TON, FROM 1889 TO 1914

in spite of the fact that a new record for ore shipments was made.

The accompanying chart No. 1 shows the prices at which iron ore has sold during the 24 years beginning Dec. 15, 1889, together with the prevailing valley prices of Bessemer and No. 2 foundry pig iron at the date at which the ore buying movement was 1909, barring some slight irregularities, the two series of lines approached nearly to being parallel, showing that ore prices have declined with the prices of iron. This was not true in 1909, when the lines representing pig iron prices had a downward tendency while those for iron ore prices continued straight. In 1910, when ore prices

At the time of the fixing of ore prices in April, 1911, and March, 1912, the downward tendency was common to both pig iron and iron ore, while at the time of the fixing of prices for 1913, the tendency of both was upward. This week, the lines for pig iron and ore again are alike in tending downward.

The accompanying table, showing the rise and decline of old range Bessemer ore and Bessemer pig iron from 1903 to 1914, discloses some interesting statistics. In 1911, the decline in pig iron was 21.1 per cent, while in ore it was 10 per cent. In 1912, on the other hand, ore declined 16.7 per cent and pig iron was only 5 per cent. At the time of fixing the prices for 1913, the advance in ore was 17.3 per cent, and in pig iron, 21.1 per cent.

Last Friday, the price of Bessemer pig iron was $14, valley, or 25 cents less than it was in 1912. The prices of No. 2 foundry valley was the same as it was in 1912. Compared with the time of fixing prices for 1913 delivery, the price of old range Bessemer ore declined 14.8 per cent and the price of Bessemer pig iron declined 18.8 per cent.

Chart No. 2

Chart No. 2 shows the fluctuations of the four classes of ore according to the value of units of iron in the natural state. For the years preceding 1907, the guarantee of Bessemer ores was 55.70 per cent natural and for the non-Bessemer ores it was 52.80 per cent, except Mesabi non-Bessemer for 1905 and 1906, when the natural iron content was 53 per cent. Before the sales for delivery in 1907 were made, the natural iron content for the base was changed to 55 per cent for Bessemers and 51.50 per cent for non-Bessemers. No change has since been made. The fluctuations in unit prices have been as follows:

VALUE OF UNIT OF IRON FOR 12 YEARS.

	—Old Range—		——Mesabi——	
	Bes'm'r, cents.	Non-Bes'm'r, cents.	Bes'm'r, cents.	Non-B's'm'r, cents.
1903	7.94	6.82	7.05	6.06
1904	5.73	5.21	5.29	4.73
1905	6.61	6.06	6.17	5.66
1906	7.50	7.01	7.05	6.60
1907	9.09	8.16	8.64	7.77
1908	8.18	7.18	7.73	6.80
1909	8.18	7.18	7.73	6.80
1910	9.09	8.16	8.64	7.77
1911	8.18	7.18	7.73	6.80
1912	6.82	5.83	6.36	5.53
1913	8.00	6.99	7.55	6.60
1914	6.82	5.83	6.36	5.53

Fluctuations of iron ore prices expressed in values of units of iron in natural state.

East Profits from Cut

Lake Superior iron ore prices under the reduced schedule just announced represent 8.35c per unit, delivered, in the Lehigh and Schuylkill valleys in eastern Pennsylvania for Mesabi non-Bessemer. At the prices ruling the past year, the cost of this grade in these districts has been 9.4c per unit, delivered. Eastern Pennsylvania furnaces, accordingly, are expected this season to use larger quantities of Superior ores than in the past year. Foreign ores, to be competitive with the new lake ore prices, must sell at about 7 cents per unit, tidewater, as the average freight to eastern Pennsylvania furnaces is about 1 cent per unit. As previously reported, some foreign ores, such as those from Newfoundland, already are offered at the 7-cent tidewater price.

Up to this time there has been a total absence this season of sales of foreign ores in the eastern territory, but the fixing of the lake schedule is expected to bring about an increase in activity in this market.

TABLE SHOWING PERCENTAGES OF ADVANCES AND DECLINES IN ORE AND PIG IRON, 1903-1914

Year.	Old range Bessemer.	Advance or decline in price.	Advance or decline in per cent.	Bessemer pig iron Valley.	Advance or decline in price.	Advance or decline in per cent.
1903	$4.50	.....	.....	$21.50	.....	.....
1904	3.25	—$1.25	—27.8	13.35	—$8.15	—37.9
1905	3.75	+ .50	+15.4	15.50	+ 2.15	+16.1
1906	4.25	+ .50	+13.3	17.25	+ 1.75	+11.3
1907	5.00	+ .75	+17.6	21.50	+ 4.25	+24.6
1908	4.50	— .50	—10.0	16.00	— 5.50	—25.6
1909	4.50	.....	.....	14.75	— 1.25	— 7.8
1910	5.00	+ .50	+11.1	19.00	+ 4.25	+28.8
1911	4.50	— .50	—10.0	15.00	— 4.00	—21.1
1912	3.75	— .75	—16.7	14.25	— .75	— 5.0
1913	4.40	+ .65	+17.3	17.25	+ 3.00	+21.1
1914	3.75	— .65	—14.8	14.00	— 3.25	—18.8

Plan Program

Mechanical Engineers Prepare for Spring Meeting

The program for the spring meeting of The American Society of Mechanical Engineers, to be held in St. Paul and Minneapolis, June 16-19, has been practically completed. Social features will be prominent, but there also will be some valuable papers including the following: "Industrial Service Work in Engineering Schools", J. W. Roe; "Classification and Heating Value of American Coal", Wm. Kent; "The Railroad Track Scale", W. W. Boyd; "Gear Testing Machine", Wilfred Lewis; "A New Flow Metering Appliance", A. M. Levin.

The sessions on Tuesday and Wednesday will be held at St. Paul and Tuesday there will be a message to the mechanical engineers by James J. Hill, former president of the Great Northern railway system. Welcome to Minnesota will be extended by Governor Eberhardt. Wednesday there will be a lecture on "Iron Ore Handling", with moving pictures, by John Hearding, superintendent Oliver Iron Mining Co., Duluth. Thursday will be spent in Minneapolis and the University of Minnesota will be visited. There will be technical excursions on Friday in St. Paul and Minneapolis. Duluth will be visited on Saturday.

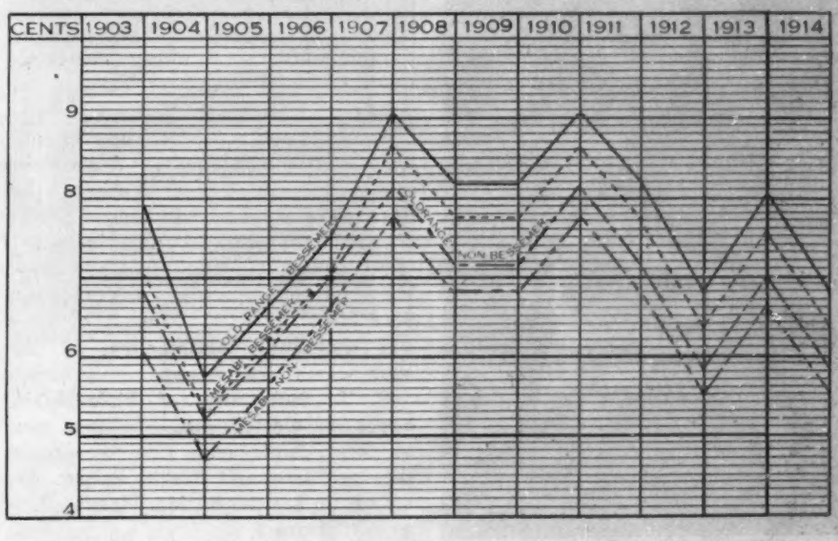


CHART 2—SHOWING RANGE OF PRICES BY UNITS OF IRON, NATURAL

Elect New Director

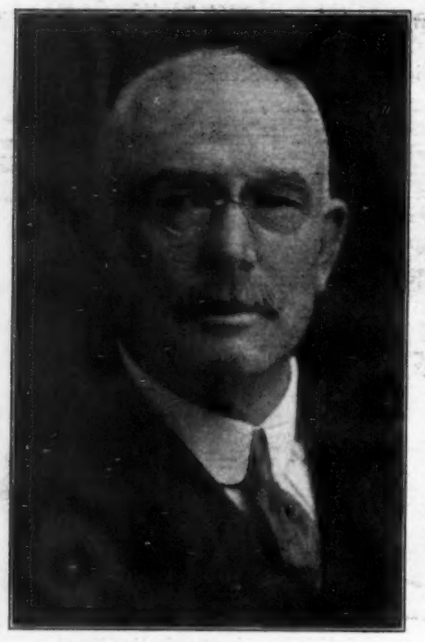
At the annual meeting of the American Iron and Steel Institute, held in New York on Monday, May 4, Leopold E. Block, vice president of the Inland Steel Co., Chicago, was elected a director for the term ending May, 1917. Mr. Block succeeds Charles S. Price, former president of the Cambria Steel Co., Johnstown, Pa., who has retired from active business on account of illness.

MEN OF THE IRON TRADE

Who they are Where they are What they are doing

The appointment of Alfred A. Corey Jr. as general superintendent of the Homestead Steel Works of the Carnegie Steel Co. was formally announced May 1. Mr. Corey, a brother of William E. Corey, former president of the United States Steel Corporation, succeeds Azor R. Hunt, whose resignation was mentioned in the April 9 issue of THE IRON TRADE REVIEW.

Mr. Corey, like his predecessor, is a practical product of the steel mill. His advancement has been rapid. His first service with the company was valued at 7½ cents an hour; that was when he has a high school boy. Mr. Corey was born in Braddock, Pa., in 1878. In the summer of 1893, during school vacation, he entered the machine shops of the Homestead plant, and in the summer of the following year accepted a permanent position in the same shops and remained there three years. In 1899, he was made assistant superintendent of the 35-and 40-inch structural mill; three years later he was assigned to the steel-



AZOR R. HUNT,
Retiring Superintendent, Homestead Steel Works

making department in open-hearth No. 3. In 1904, Mr. Corey went to the company's plant at North Sharon, Pa., as superintendent of the open-hearth department. A year later he was appointed general superintendent of the Donora works, and returned to Homestead three years later as assistant general superintendent of the plant at that place.

Mr. Hunt was given a banquet last Saturday night by operating officials

J. F. DOUGHERTY,
New member, American Iron and Steel Institute

of the Carnegie company in recognition of his 27 years' service with the company.

R. H. Watson, former superintendent of the open-hearth department at the Homestead Steel Works of the Carnegie Steel Co., has been appointed assistant general superintendent of the plant, succeeding Mr. Corey. Mr. Watson's former position has been filled by W. A. Maxwell Jr., who was assistant superintendent of the open-hearth department.

E. T. Stotesbury, of Philadelphia, has been elected president pro tem. of the Temple Iron Co. to succeed the late Geo. F. Baer. Robert W. deForest, has taken Mr. Baer's place as a director.

J. F. Dougherty, recently elected a member of the American Iron and Steel Institute, was on May 1 placed in charge of the Guernsey Works, Cambridge, O., of the American Sheet & Tin Plate Co., as manager. The present year will round out 21 years of continuous service by him to the American Sheet & Tin Plate Co. Mr. Dougherty was born at Elizabeth, Allegheny county, Pa., in 1867, and was educated in the Soldiers' Orphans' School of Pennsylvania. He does not make any claims to learned degrees, but modestly remarks that he is a graduate of the "school of experience and hard knocks". After being employed by the Pennsylvania Railroad Co., lines east of Pittsburgh, six and one-half years as locomotive fireman, he embarked in the iron business in 1893 at Apollo, Pa., with the Apollo Iron & Steel Co. as a day hand on sheet mills. He served through various positions in the sheet mills up to that of sheet roller, which position he filled for 14 years. He was promoted to the superintendency in 1907, and transferred to Struthers, O. In 1910, he went to Muncie, Ind., as manager for one of the American Sheet & Tin Plate Co.'s plants in that city. Later he served 15 months in the special agent's department of the same company at Pittsburgh.

William E. Kelly has been re-elected president and general manager of

ALFRED A. COREY,
General Superintendent, Homestead Steel Works

the Kelly Reamer Co., Cleveland. The other officers re-elected were as follows: W. A. Calhoon, vice president; H. J. Maxwell, secretary; O. H. P. Davis, treasurer; E. B. Jessup, T. A. Torrance and George Bauer.

They All Call Him "The Captain"

Robert Woolston Hunt Who Has Been in the Van in Steel Making for a Long Lifetime is One of Our Foremost Engineers

BY GEORGE H MANLOVE

THE CAPTAIN", they call him, from the telephone girl at the information desk in his offices to the inspector at the outermost post of the great organization he has built up.

Who?

Why, Captain Robert Woolston Hunt, head of Robert W. Hunt & Co., engineers.

If you ask the Captain how he earned the title, he will tell you with pride he earned it in the war of the rebellion, when he served his country at the expense of his individual interests.

But to his friends and employes he is captain of a regiment in the great army of soldiers of the common good, who are doing a work to make the world better and safer and more comfortable for us all.

And the Captain is no martinet, ruling by fear and by violent means. Far from it. He is gentle and kindly, soft spoken as a woman and without a trace of hardness. But he exacts obedience, which his helpers are glad to give.

"We all love the Captain," said one employe, and the way the title is used is an earnest of the fact, for it sounds like a term of endearment for a lovable man, whose contact with steel and iron and concrete has left him free from their characteristics.

When a skyscraper is to be built, or a bridge or a great steel plant, the services of the Captain may be had to assure the builder the materials are all they should be and that they are erected according to the specifications laid down by the designer.

With a trained corps of men who know steel and iron and concrete from the inside out, as well as the processes to give it strength and other characteristics necessary to perform its work properly, the Captain has multiplied his own power of knowledge a hundred fold and placed it where it is available for any one's use. Material inspected by the Captain's workers has his guarantee and none is better.

When the history of steel is written, the name of Robert W. Hunt will be linked with those of Bessemer, Siemens, Carnegie, Howe, Bradley, Stoughton and the rest, whose efforts have been given to developing the great industry.

He was a pioneer in the use of a laboratory for chemical analysis at a steel plant, he made the first steel rails produced in America on a commercial scale and built the first automatic rail mill tables ever used.

He was born Dec. 9, 1838, in Fallsington, Buck County, Pa. His father, Dr. Robert A. Hunt, of Trenton, N. J., was a graduate of Princeton College, and the University of Pennsylvania. His mother was Martha Lancaster Woolston.

He spent several years learning the practical side of iron-making in the rolling mills of John Burnish & Co., Pottsville, Pa., and later took a course in analytical chemistry in the laboratory of Booth, Garrett & Blair, upon the completion of which he entered the employ of the Cambria Iron Co., Johnstown, Pa., and Aug. 1, 1860, established for them the first laboratory in America as a direct part of an iron or steel organization.

CAPTAIN ROBERT WOOLSTON HUNT

In the fall of 1861, he entered the United States military service and was placed in command of Camp Curtin, Harrisburg, Pa. He served as musfering officer for the state of Pennsylvania, with the rank of captain and in 1864 assisted in recruiting Lambert's Independent Mounted Company, P. V. He was mustered into the United States service as a sergeant, having tossed up with a friend, who had also participated in recruiting the company, as to which one should receive a lieutenant's commission.

Upon being mustered out of service, he returned to the employ of the Cambria Iron Co., and was sent by them to the experimental Bessemer works at Wyandotte, Mich., of which it was part owner. He was placed in charge of those works in July, 1865, and so continued until May, 1866, when the Cambria company called him back to Johnstown to take charge of its steel business, as they intended to begin at once the erection of a Bessemer steel plant. This was not done for several years, and in the meantime, the Cambria company undertook the rolling of steel rails for the Pennsylvania Railroad Co. from ingots produced by the Pennsylvania Steel Co.'s works at Steelton, Pa., that company's rail mill not being completed. Mr. Hunt had charge of the steel for this operation, and these were said to be the first steel rails made in America on a commercial order.

Later he assisted George Fritz, Cambria's chief engineer, in designing and building their Bessemer works, and assumed charge of it on its completion, July 10, 1871, continuing until Aug. 1873, when he resigned his position. Sept. 1, 1873, he entered upon the duties of superintendent of the Bessemer works of John A. Griswold & Co., Troy, N. Y. In March, 1875, he became general superintendent of the Albany & Rensselaer Iron & Steel Co., which had acquired the works of John A. Griswold & Co. and Erastus Corning & Co. This organization became later the Troy Steel & Iron Co. He remained in charge until 1888. During those years he almost completely rebuilt the various works of the company, and also erected a large blast furnace plant of the most complete character.

Mr. Hunt has taken out several letters patent on steel and iron metallurgical processes and machinery, both individually and in conjunction with John E. Fry, Wm. R. Jones, Dr. August Wendel and Max M. Suppes. Mr. Hunt put in the first automatic rail mill tables, and later the Hunt-Jones-Suppes rail mill feed tables were used under licenses by the majority of the rail mills in the United States.

On Dec. 5, 1866, he was united in marriage to Miss Eleanor Clark, of Ecourse, Mich.

In April, 1888, he established the bureau of inspection, tests and consultation of Robert W. Hunt & Co., with principal offices in Chicago, Ill., to which city he removed in the spring of 1888. He served three terms as commander of John A. Griswold Post No. 338 G. A. R., of Troy, from which position he resigned on removing from that city.

Mr. Hunt is a member of the American Institute of Mining Engineers, and was president in 1883 and again in 1906. He is a member of the American Society of Mechanical Engineers, and was president in 1890. He is a member of the Western Society of Engineers, and was president in 1893. He is also a member of the American Society of Civil Engineers, Canadian Society of Civil Engineers, The Institution of Civil Engineers, the Institution of Mechanical Engineers, and the Iron & Steel Institute of England. He is a member of the American Society for Testing Materials, and was president in 1912. He is the American member of the Council of the International Association for Testing Materials.

Awarded Fritz Medal

In 1912, by the John Fritz medal committee, representing the American Society of Civil Engineers, American Institute of Mining Engineers, American Society of Mechanical Engineers and the American Institute of Electrical Engineers, he was awarded the John Fritz medal, "for his contributions to the early development of the Bessemer process".

Mr. Hunt has contributed many papers to the proceedings of the several societies, of which he is member, and frequently lectures before scientific bodies. He is and has been for many years a trustee of the Rensselaer Polytechnic Institute, Troy, N. Y.

Mr. Hunt is a member of the Chicago Engineers, Mid-Day, Saddle and Cycle, Chicago, South Shore, Illinois Athletic, Glen View, Chicago Golf, Winnetka County, Montreal Engineers, Engineers of New York and Mexico City Country clubs. He has always been interested in out-of-door sports, and was, in his earlier life, a cricket and baseball player, and is now an enthusiastic golfer.

How Molybdenum Steel Corrodes

In a paper read before the British Iron and Steel Institute at its May meeting, C. W. Marshall and J. Newton Friend gave some interesting information regarding the influence of molybdenum on the corrodibility of steel. A number of tests were made by the authors on small steel cylinders 1.4 centimeters in diameter and 4.0 centimeters in length, weighing approximately 40 grams each. The analysis of the steels are given in Table I.

Table I.

ANALYSES OF STEELS TESTED

Steel No.	Carbon, per cent.	Molybdenum, per cent.	Manganese, per cent.	Silicon, per cent.	Sulphur, per cent.	Phosphorus, per cent.
1	0.14	0.0	0.339	0.157	0.036	trace
2	0.195	1.030	0.218	0.047	0.025	0.016
3	0.246	2.176	0.216	0.064	0.026	0.015
4	0.190	4.110	0.242	0.036	0.020	0.017
5	0.40	0.0	0.357	0.084	0.042	trace
6	0.445	1.054	0.230	0.087	0.026	0.014
7	0.442	2.181	0.270	0.075	0.025	0.015
8	0.487	4.009	0.292	0.038	0.024	0.016
9	1.04	0.0	0.253	0.081	0.049	trace
10	1.215	1.096	0.250	0.124	0.032	0.017
11	1.210	2.109	0.238	0.071	0.023	0.015
12	1.060	4.019	0.230	0.039	0.020	0.016

Five series of experiments were carried out, and the results are, for the sake of easy comparison, grouped together in Table II. In calculating the corrosion factors for each series the loss in weight of steel No. 1 is taken as 100.

Samples of steel, resting on discs of paraffin wax, were placed in beakers containing 300 cubic centimeters of tap water and shielded from light. After 46 weeks the steels were removed, scraped free from rust and dried in a steam oven. They were then weighed, the loss in weight being taken as a measure of the corrosion.

Other Tests

Salt water tests were carried out in an exactly similar manner to the tap water ones, the liquid corrosive medium being 3 per cent salt solution. In the sulphuric acid tests the corroding liquid consisted of a solution of 0.5 gram of sulphuric acid in 1,000 grams of water. The liquid was frequently renewed. Tests were also made with a corroding liquid consisting of a solution of 5.0 grams of sulphuric acid in 1,000 grams of water. The liquid was frequently renewed. In alternate wet and dry tests, the steel was laid upon a perforated disc of paraffin wax suspended in a metal bath, which was alternately filled with water and emptied. The steel was thus exposed to alternate wet and dry action.

An examination of Table II makes clear the following points: Molybdenum up to 4 per cent does not appear to exert any marked influence upon the corrodibility of steel, when exposed to tap water, salt solution and dilute sulphuric acid. The results of exposure to 0.5 per cent sulphuric acid are almost identical with the mean corrosion factors obtained by the exposure of the steels to the other four corroding agencies listed in the table. This is interesting, because it so frequently happens that the solubility of steel in the stronger solution of sulphuric acid gives entirely unique results, which are quite untrustworthy guides as to the behavior of the metal towards neutral corroding agencies.

Effect of Molybdenum

The greatest variation in the corrosive factors is exhibited in the wet and dry tests, the resistance of the steels greatly increasing with the percentage of carbon. The molybdenum, on the other hand, tends to increase the corrosion very markedly. It is difficult to say what conclusions we are to arrive at from this, but if, as the writers believe, the wet and dry tests correspond most closely to the conditions under which the steel ordinarily corrodes in practice, it is clear that, from the corrosion point of view molybdenum is an undesirable constituent of steel if present to a greater extent than 1 per cent. These conflicting results emphasize still more

(*Continued on page* 849)

New Reagent for Etching Steel

A Discussion of the Method of Using a Ferric Chloride Reagent for Determining the Distribution of Phosphorus in Mild Steel

BY WALTER ROSENHAIN and J L HAUGHTON

IN ATTEMPTING to etch a copper alloy which was attached to a plate of mild steel, the authors employed the ferric chloride reagent ordinarily used for etching brass and bronze, and they noticed that, while the steel was exposed to the reagent, as would have been anticipated, the copper alloy was not acted upon, but the reagent exerted a distinct etching action on a portion of the attached steel which had been polished. The appearance of the steel surface thus etched was so interesting that the authors were led to examine more closely the behaviour of this etching reagent, when applied to steel. The principal interest and importance of the new reagent, however, lies in the fact that it reveals in a clear and striking manner the distribution of phosphorus, particularly in mild steels, yielding results which compare favorably with those hitherto obtainable only by the heat-tinting method devised by Stead. It may be stated at once that the action of the new reagent consists in the deposition on the surface of the steel of thin films of metallic copper. In the reagent as first used, the copper was present owing to the fact that the acidulated ferric chloride solution had been repeatedly employed for the etching of copper alloys; in the reagent described below, the copper is introduced into the solution in definite proportions. The use of solutions of copper salts for the etching of iron and steel is not, of course, new, the reagent described by Heyn consisting of a 12 per cent solution of copper-ammonium chloride in water being one example, while Dr. Stead has informed the authors that he has also employed copper solutions as etching reagents. Doubtless others have also experimented in that direction. In Heyn's method, however, the deposition of the copper is of quite secondary importance—in fact, the thin film of copper is not adherent and must be removed before the effect of the etching becomes apparent. With the new regeant described in this paper, however, the deposited film of copper, although very thin, is adherent and is itself the cause of the formation of the "etched" pattern. The process is thus to some extent analogous to that of heat-tinting, which consists in the disposition in varying degrees of a thin coating of oxide, sulphide, or other compounds; with the authors' process this is simply replaced by a thin film of copper, but with the concurrent advantage that this takes place in the presence of an acid reagent whose action is sufficient to ensure the removal of the surface layer due to polishing.

In order to secure satisfactory and uniform action, it is necessary that the composition of the new reagent should conform with considerable exactitude to the following formula:

Ferric chloride (Fe_2Cl_6)	30 grammes.
Hydrochloric acid (conc.)	100 cu. centimetres.
Cupric chloride ($CuCl_2$)	1.0 gramme.
Stannic chloride ($SnCl_2$)	0.5 gramme.
Water	1 litre.

The proportions have been arrived at after a considerable number of trials in which the composition of the reagent was somewhat widely varied. Success, however, appears to depend upon an accurate balance of the dissolving effect of the hydro-chloric acid present and the rate of deposition as determined by the concentration of copper; if there is too much acid and too little copper, the effect is a mere ordinary etching by the hydrochloric acid in which the pearlite is attacked while the ferrite is tarnished by too thin a deposit of copper. If, on the other hand, the concentration of copper is too high or that of the acid too low, the result is a uniform deposition of copper over the entire surface. The presence of the small amount of stannic chloride appears to be helpful.

The use of the reagent requires a little care. It is particularly necessary to have the surfaces when prepared

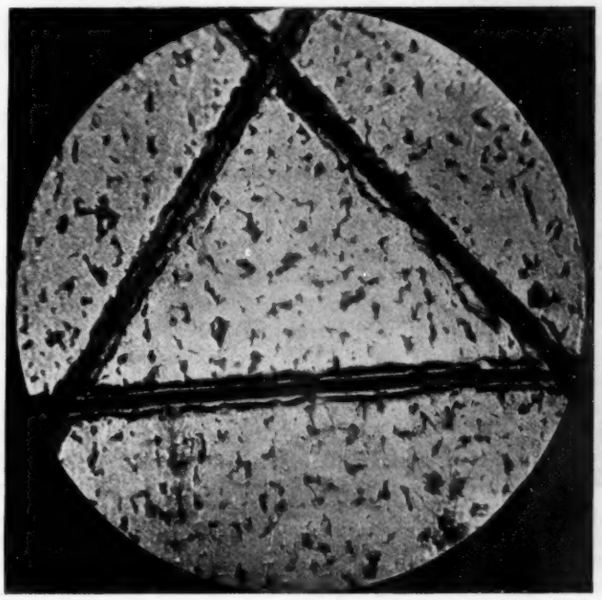


FIG. 1—STEEL ETCHED WITH ORDINARY REAGENT

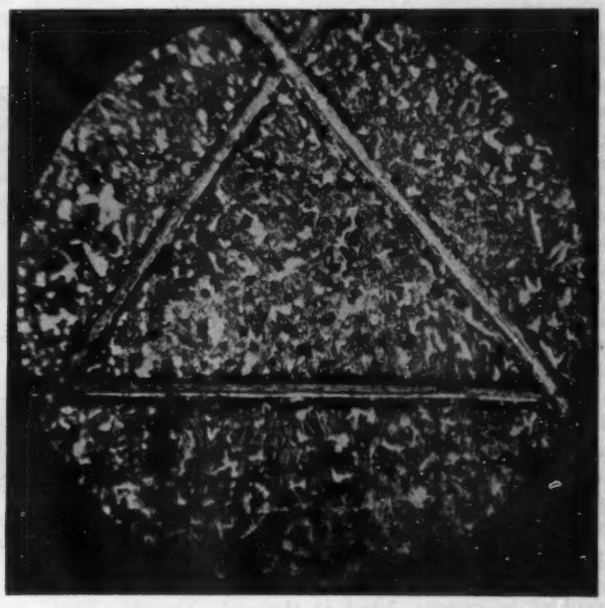


FIG. 2—STEEL ETCHED WITH NEW REAGENT

From a paper presented at the May meeting of the British Iron and Steel Institute.

for etching perfectly clean; this is best secured by finishing the polishing on a very wet block, when the specimen can be taken off in a perfectly

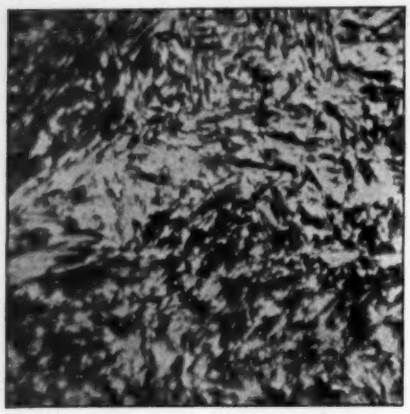


FIG. 3—MARTENSITE STRUCTURE MAGNIFIED 1,000 DIAMETERS

clean and bright condition; the specimen is then washed in a small jet of absolute alcohol and completely immersed in a bath of the reagent. The same portion of reagent must not be used a second time. The duration of etching required depends partly upon the character of the steel and partly upon the depth of etching desired. It varies from ten seconds to two minutes according to circumstances. It will frequently be noticed that in addition to the typical etching effect, the surface shows discolored patches surrounding small black holes or pits. Although the occurrence of these markings is apt to mar the beauty of the finished preparation, they must not be regarded as defects, since they arise consistently from certain causes intimately associated with the nature of the steel itself. This matter is referred to in greater detail at the end of the paper.

Effect of the Reagent

In a mild steel exhibiting the usual pearlite-ferrite structure it is found that whereas the ordinary etching reagents, such as nitric acid, picric acid, etc., rapidly darken the pearlite by attacking and roughening it, leaving the ferrite practically unaltered, the new reagent reverses this procedure. The pearlite is left untouched, appearing white and bright under normal light, while the ferrite is covered with a film of copper having a slightly rough surface texture, and therefore appearing black under normal light, particularly if the period of etching has been somewhat long. The resulting effect is, however, striking; it is shown in Figs. 1 and 2 in comparison with the etching pattern produced by picric acid, the action of the new reagent being shown in Fig. 2. The two figures are photographs of the same area which has been marked by means of three scratches enclosing a triangle which can be readily recognized in both photographs, and which facilitates the identification of individual ferrite and pearlite patches. It will be seen that the two photographs bear the relation of positive and negative to one another.

When applied to quenched steel, the new reagent yields patterns which are of the same kind as those produced by other means, that is, there is no reversal in this case. The new reagent, however, develops the structure of martensite, particularly in low carbon steels quenched from a high temperature, in a remarkably clear manner. An example of martensite thus etched is shown in Fig. 3 under a magnification of 1,000 diameters. An example of somewhat coarser martensite under the same magnification is shown in

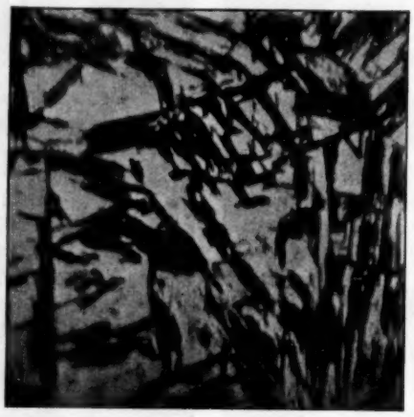


FIG. 4—COARSE MARTENSITE STRUCTURE MAGNIFIED 1,000 DIAMETERS

Fig. 4. These figures under a high magnification are of particular interest as showing the sharp outlines of the deposited copper films in conformity with the constituents upon which they are deposited. This in itself is a somewhat striking and surprising effect. Troostite and sorbite are also darkened by the new reagent.

An interesting observation has been made by the authors on a sample of mild steel containing approximately 0.4 per cent of carbon which was quenched while passing through the temperature of Ar1. The resulting structure as revealed by picric acid is shown in Fig. 5 under a magnification of 1,000 diameters. This presents the ordinary appearance of troostite (possible sorbite) and ferrite. Between the "white" areas, however, of this figure there appears to be a slight difference, one group of grains showing a somewhat more mottled surface than the others. On repolishing and etching this surface with the new reagent, a negative pattern was again obtained, such as is always found with hypo-eutectoid steels which have passed through the critical range. The appearance of the same area after repolishing and etching with the new reagent is shown in Fig. 6. The curious fact, however, is that while both the black and white areas as seen in Fig. 5 appear black in Fig. 6, the slightly mottled areas in Fig. 5 have remained white under the action of the new reagent, which thus affords a clear distinction between the two constituents which under ordinary modes of etching appear very similar. The exact meaning to be attached to this differentiation will, however, require considerable further investigation; the observation is described here in order to indicate the possibilities of the new reagent in studying the transition constituents of hardened and tempered steels.

Etching Commercial Steels

On applying the new reagent to polished longitudinal sections of commercial steels, it was found that the etching action resulted in the appearance of a strongly-marked banded structure which instantly recalls the typical banded appearance obtained in phosphorus steels by Stead's method of heat-tinting. In order to ascertain whether the banding thus indicated by the new reagent corresponds with that produced by heat-tinting, the authors undertook careful comparisons of the patterns obtained by the two methods. Dr. J. E. Stead, F. R. S., very kindly supplied a specimen of phosphoric steel which had been heat-tinted by him, and after photographing a marked area of this specimen it was

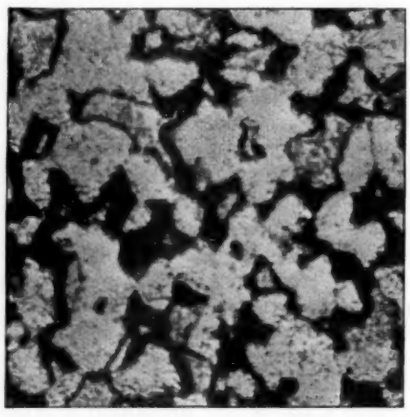


FIG. 5—ORDINARY ETCHING OF 0.4 PER CENT CARBON STEEL

repolished and etched with the new reagent. Similar comparisons were also made on other specimens of steel, showing well-marked banding and subjected

to heat-tinting by the authors. The result of their observations is to show conclusively that if the new reagent is applied until a certain well-defined state in the development of the pattern is reached, that pattern is identical, even in its finer details, with that obtained by heat-tinting. The accuracy of the comparison between the two methods is illustrated in the photomicrographs Figs. 7 and 8, the former showing the pattern obtained by heat-tinting, the latter that developed by the new reagent; tally scratches are visible in both figures. It is interesting to notice, however, that the stage of etching with the new reagent represented by Fig. 8 is not the first stage of that process; if the specimen is removed from the reagent after a short time (ten to thirty seconds according to the phosphorus content of the steel) a pattern like that illustrated in Fig. 9 is obtained. If this is compared with Figs. 7 and 8 it will be seen that the core or nucleus of each of the dark areas in these figures is represented by a dark patch in Fig. 9. This indicates that the new reagent is extremely sensitive to the presence of phosphorus and possibly to other dissolved impurities, so that the first effect is to darken that portion of the ferrite which contains the smallest amount of phosphorus in solution; as etching proceeds, this dark area spreads until a stage is reached where the pattern corresponds exactly with that obtained by heat-tinting. More prolonged etching beyond this point does not appear to cause any further spreading of the dark areas, and after a time merely produces a roughening of the surface.

Figs. 7, 8, and 9 show this pattern under a magnification of 15 diameters; the correspondence between the two, however, can also be traced under much higher magnifications. This is shown in

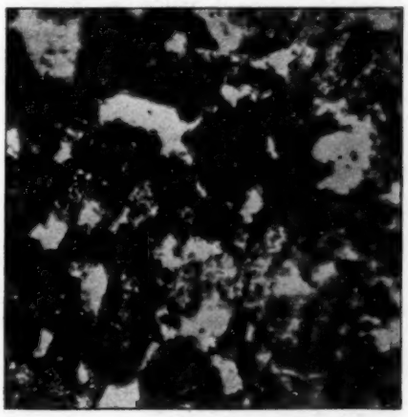


FIG. 6—SAME STEEL AS IN FIG. 5 ETCHED WITH NEW REAGENT

Figs. 10 and 11, where the two modes of developing the pattern are compared over the same areas under magnifications of 150 diameters. In this particular example the action of the new reagent has not been pushed quite to the limit and consequently the white streaks in Fig. 11 are still rather wider than those, obtained by heat-tinting, in Fig. 10.

Phosphorus in Mild Steels

The great delicacy with which the new reagent reveals even the more minute details of phosphorus distribution in mild steels affords an interesting means of studying that distribution. This study has not as yet been carried very far by the authors, but a few interesting observations may be recorded.

In Fig. 12 is illustrated a typical example of the phosphoric banding of a mild steel as revealed by the new reagent. If this steel is etched in picric acid, only a few of the largest bands are indicated, these being cases where the concentration of phosphorus and other impurities has been high enough to expel the carbon from that region,

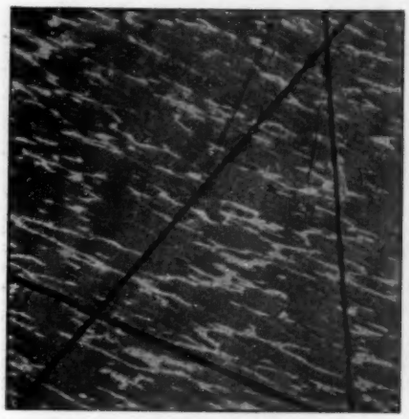


FIG. 7—PHOSPHORUS STEEL HEAT TINTED

thus leaving a carbon-free band, sometimes called a microscopic "ghost," in the steel. Many of the wider bands, as revealed by the new reagent, however, are not accompanied by any serious diminution in the carbon content; these would not be revealed by etching with picric acid, but are clearly shown by the new reagent whose action is independent of the presence or absence of pearlite. In Fig. 12 it will be seen that the pearlite areas can be seen faintly even in the large white bands which run across the figure. A transverse section of a steel possessing this banded structure shows under the new reagent patches of more or less irregular shape which represent the transverse sections of long bands seen in the other surface. An example of this kind is shown in Fig. 13. This appearance in transverse sections, however, suggests the mode of origin of this distribution of phosphorus. The structure seen in Fig. 13, particularly if viewed from a little distance, so that the pearlite detail becomes more or less obliterated, suggests the outlines of distorted dendritic cores similar to those seen in brass or German silver before

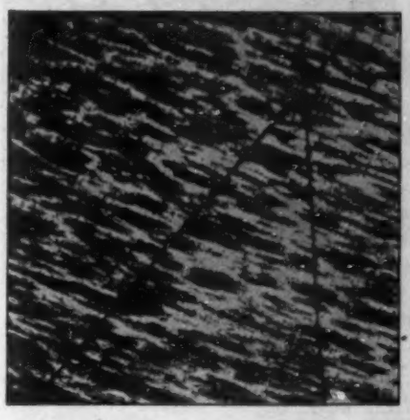


FIG. 8—PHOSPHORUS STEEL ETCHED WITH NEW REAGENT

complete homogeneity of the solid solutions had been attained. This suggests that the phosphoric bands are lineal descendants of the phosphoric portions of the austenite crystals which were formed when the steel first solidified from fusion. These would be large crystals containing a high proportion of phosphorus in the peripheral region, much as the crystals of cast brass have a higher zinc content in their outer portions. During subsequent rolling or forging operations these crystals become elongated into long bands, the bands corresponding to the phosphorus-free cores alternating with those corresponding to the phosphorus-rich outer layers. The inner structure of these crystals is, of course, broken up and replaced by a multitude of new and smaller crystals both as the result of mechanical work and annealing and as a consequence of repeated passage through the critical temperatures. But this recrystallization cannot effect what may be termed the geographical distribution which can only be altered by the action of diffusion, and it is well known that the rate of diffusion of phosphorus is very slow. If this explanation is correct, it follows, that the width and distribution of the phosphorus banding in mild steel is a direct consequence of the size and arrangement of the crystals of the original ingot.

Another interesting feature in connection with the phosphorus bands of mild steel is the manner in which the arrangement of these bands is affected by plastic deformation. This again depends upon the fact just referred to, that the "geographical" distribution of phosphorus can only be altered by diffusion and not by crystallization; this is illustrated by an experiment made by the authors on a sample of mild steel boiler plate which exhibited banding in

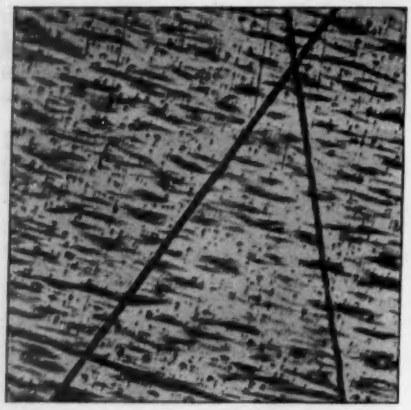


FIG. 9—THE SAME STEEL AS IN FIG. 8 ETCHED LESS DEEPLY

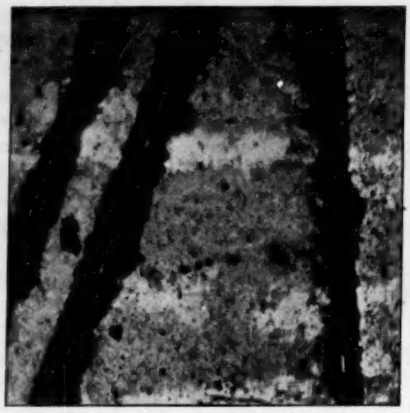


FIG. 10—HEAT TINTED STEEL MAGNIFIED 150 DIAMETERS

FIG. 11—ETCHED STEEL MAGNIFIED 150 DIAMETERS

a very marked degree. An impression was made on the surface of this steel by means of a Brinell hardness tester, in the direction of right angles to that of the banding. A section cut through this impression shows the manner in which the bands have been displaced by the plastic deformation of the metal.

This is illustrated under a very low magnification (12 diameters) in Fig. 14. The specimen was then annealed for one hour at 800 degrees Cent. In this particular case the annealing had materially reduced the width and intensity of the banding, the grey appearance obtained on etching after annealing being responsible for the dull appearance of Fig. 15, in which the section is represented at that stage. It will be seen, however, that the curvature of the bands around the impression of the ball, and indeed the identity of the bands themselves, has remained unaltered, although there can be no doubt that vigorous recrystallization must have occurred, particularly in the vicinity of the ball impression.

Mention has already been made of the frequent appearance of black spots surrounded by discolored patches in specimens of steel treated with the new reagent. The authors endeavored by extreme care in polishing by various methods and materials to eliminate this feature, but found that it could not be eliminated in that way if once present, and it also became evident that these patches represent definite features in the steel, since they reappear in the same positions on repeated repolishing. In one instance of a badly segregated steel bar supplied to the authors by the kindness of J. C. W. Humfrey, of Sheffield, the whole central region of the bar was thickly covered with these patches, and this recurred on all specimens that were examined. On studying these patches more closely, it is found that as a rule they center about a slag enclosure of some kind, although cases have been observed in which slag enclosures are not surrounded by these patches, and others in which no sign of enclosure could be found at the center of the patch. The explanation probably lies in the sensitiveness of the new reagent to impurities present in the steel, and it is not surprising to find that there is a concentration of such impurities in the immediate vicinity of slag enclosures; it may indeed be that these enclosures are themselves more or less soluble in the steel immediately surrounding them, and that it is the presence of an "aura" of such dissolved matter which gives rise to the patches under the action of the reagent. Where enclosures of sulphide of manganese are present, these will be attacked by the hydrochloric acid contained in the reagent, and the resulting hydrogen sulphide will blacken the copper deposited in the vicinity of the enclosures. This point, like many others which have occurred in the study of the reagent, opens up possibilities of much further interesting inquiry.

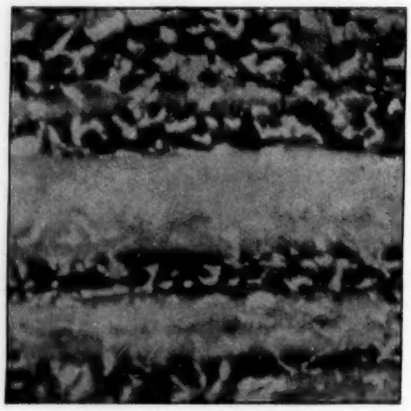


FIG. 12—PHOSPHORUS BANDS IN MILD STEEL

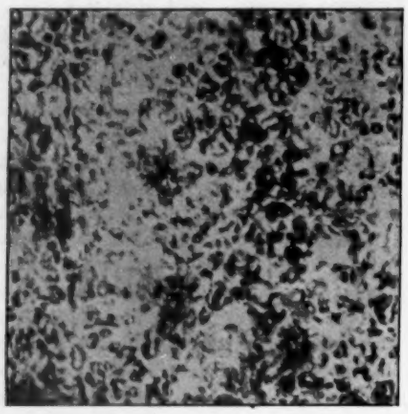


FIG. 13—TRANSVERSE SECTION OF BANDED STEEL

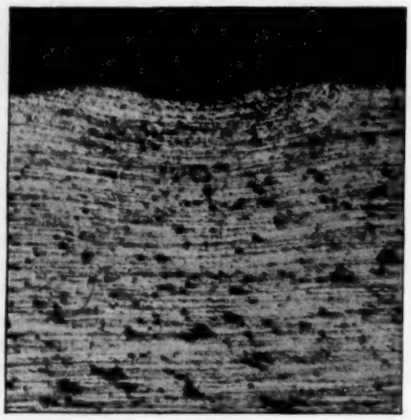


FIG. 14 — BOILER PLATE ETCHING MAGNIFIED 12 DIAMETERS

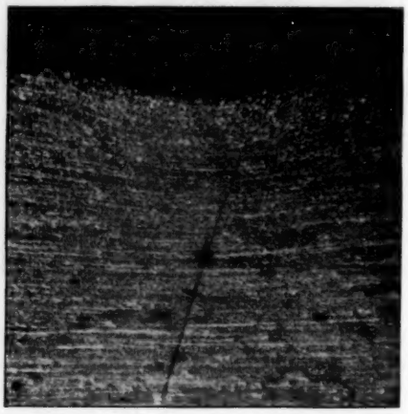


FIG. 15 — BOILER PLATE ETCHED AFTER ANNEALING

Improvements in Case Hardening

A Discussion of the Use of Color Pyrometers for Determining the Temperature of Red Hot Steel, With Other Suggestions on Case Hardening

BY HENRY L HEATHCOTE

EVEN to the casual visitor and observer it must be obvious that, generally speaking, the British machine shop is ages in advance of the hardening shop. In the machine shop are to be found highly differentiated machine tools, each the last word in scientific design and construction, embodying the best engineering knowledge and skill of many nations. The tools, as often as not of high-speed steel, and the grinding wheels, are both the outcome of special research in different branches of chemical industry. The men are well trained and well paid, and the organization of the shop is another testimony of the state of development arrived at. Not only are its tools, its plant and its employes of superior grade, but its output is subjected to strict viewing by skilled men using instruments of precision. Needless to say this reacts on the shop as a whole and makes for rapid rectification of faults and a high standard in every part.

Compare this state of affairs with that prevailing in a typical hardening shop some years ago. Instead of a well-lit, well-ventilated and comparatively clean shop, we find a dark, grimy shed, something like a miniature gas works, unbearably hot and reeking with cremated ox-remains and fishy oil. Here a gang of men pound a dusty black mixture into iron pots round some of the articles that have just come from the machine shop or automatic shop; there another gang, equally grimy but more oily, wield

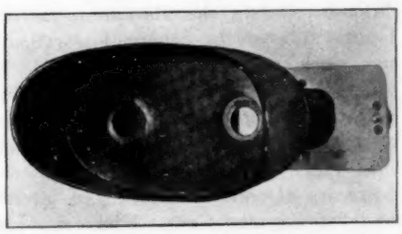


FIG. 2—OUTSIDE VIEW OF PYROMETER FOR OBSERVING TWO TEMPERATURES

tools that Tubal Cain may have used—their plant, crude furnaces, uncontrolled save by the unaided eye.

Not only were their tools and plant crude, their materials and labor were crude, too. The labor employed was anything but skilled, and the case-hardening compositions savored more of quack medicines than British Pharmacopoeia preparations. What little

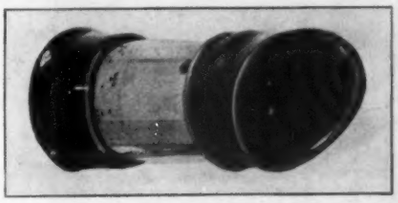


FIG. 1—ADJUSTABLE FORM OF PYROMETER FOR OBSERVING TEMPERATURES OVER A RANGE OF 400 DEGREES CENTIGRADE

viewing was done threw little or no light on the causes of distortion, softness or cracks. And this was the shop to whose tender mercies much of the machine shop output was handed over, there to be made or marred.

This, then, was the problem: to raise this outcast, isolated and forlorn process of chemical industry to the dignity and standing of machine-shop practice; to investigate the materials it employs and throw light on their mode of action; to provide simple means of controlling the furnaces and of measuring the resultant hardness and resistance to shock; in a word, to do for the hardening shop what science and industry had already done for the machine shop.

An Improved Pyrometer

We started out at the furnace end and decided to install pyrometers, but were soon met by the fact that an efficient pyrometric outfit for a battery of thirteen muffles is an expensive thing, especially for an industry where the competition is so keen and the work so varied. Moreover, it threatened to cost something to keep it in working order; and on second thoughts it seemed very questionable whether thermo-electric and resistance pyrometers would be suitable for a system starting with a hot furnace full of cold work, or for ascertaining the temperature of an isolated article.

The Fery instruments were then unknown, so the author started investigations at the Rudge-Whitworth Research Laboratory with the object of ascertaining the temperature of red-hot bodies from their color. On examining the spectrum of a red-hot piece of steel it is found to elongate at both the red and violet ends and to increase in intensity all along as the temperature rises. This suggested the possibility of ascertaining the temperature of red-hot bodies by means of a direct vision spectroscope provided with a graduated scale (also used by Hempel), but it soon became evident that the difficulty of seeing just where the green ended precluded the possibility of anything approaching accuracy; and the extension of the red end was not sufficient for the purpose. Attempts were made, by screening off the brighter parts of the spectrum, to render the green or blue end more distinct, but it was found that the end point varied considerably with the same observer, and that many eyes cannot focus a sharp image on the retina when pure blue or green rays are transmitted.

Light from an acetylene flame was passed through the colored solutions, organic and inorganic, and of various concentrations, then analyzed by a spectroscope and the absorption spectra plotted; but the difficulty and endless work involved in determining the intensity (or degree of absorption) of the various colors made it commercially necessary to be content with an approximation to the required curve.

In conducting these experiments the author found that the eye is certainly

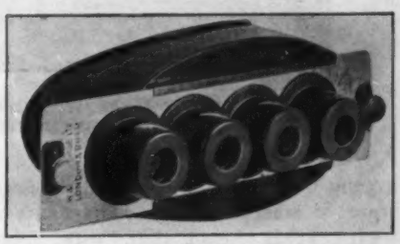


FIG. 3—INSIDE VIEW OF PYROMETER FOR OBSERVING TWO TEMPERATURES

more sensitive to small variations in the region of the dark red than in any other region, and this led to choosing dye solutions that transmitted an excess of red. A very feeble light, whatever the color, appears grey or grey-

Abstract of a paper presented at the May meeting of the British Iron and Steel Institute at London.

ish green. This is said to be due to the rods of the retina being more sensitive to light than the cones. As soon as the intensity becomes sufficient the cones respond and give the impression of color. When the observer is looking through one of these dye solutions the object is either invisible or very faintly visible, and it is found that the change from this grey or greyish green to dark red is far sharper than the change to any other color tried—particularly the greenish blue at the end of the spectrum of steel at 700 to 1,000 degrees Cent. It is found that, with solutions of this kind, a difference of temperature of 5 degrees Cent. can be detected. That is to say, an excess of 5 degrees Cent. sends sufficient radiations to the eye to render the object visible through the solution in question. Different observers are found to agree closely as to the temperature, showing that the error due to the different sensitiveness of different eyes is but little greater than the experimental error. With untrained observers the error may be 10 degrees Cent.

Having found a range of solutions capable of absorbing the rays emitted by red-hot steel at various temperatures, and at the same time suited to the peculiarities and conditions of the eye, the author proceeded to investigate the permanence of the various mixtures in the dark and under the action of light; also their behavior in contact with retaining vessels such as glass and india-rubber. Some were found to decompose on keeping, some changed in color, some precipitated; others were found to be soluble in glass. Some were found to withstand the action of light, in contact with glass and india-rubber, without any apparent change. Professor Campion has independently confirmed the stability of some of the dyes chosen by the drastic test of exposing two pairs of cells to full sunlight for over a year. He found no deterioration in the solutions.

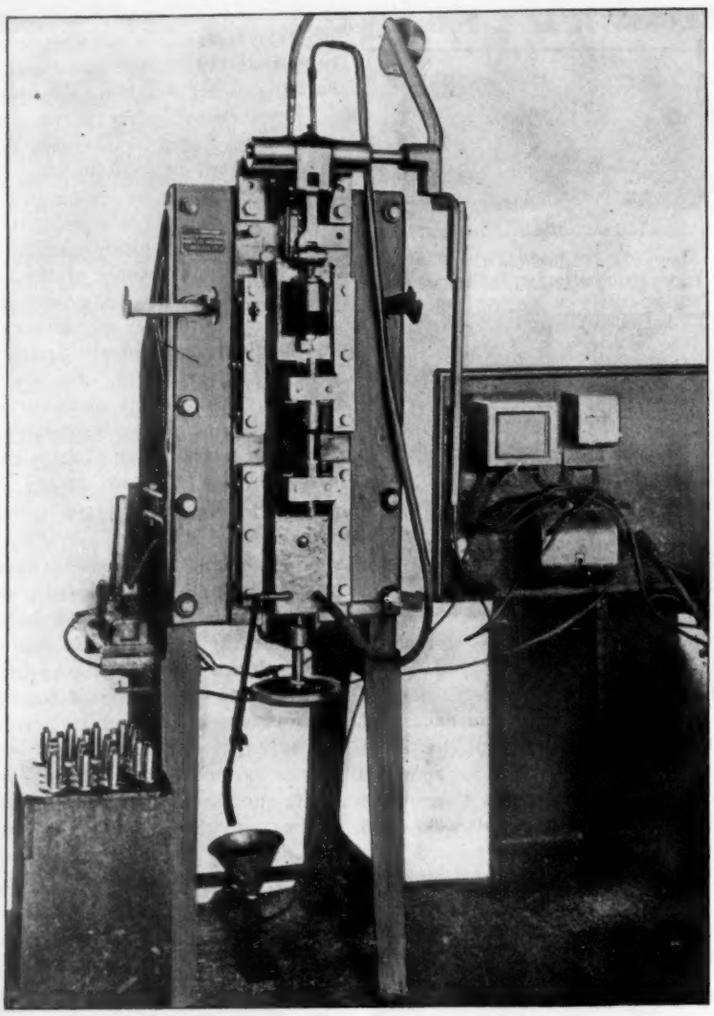


FIG. 4—ELECTRIC WELDER ARRANGED FOR TEMPERING CASE-HARDENED ARTICLES

The chosen solutions were then calibrated by viewing the end of a steel cylinder heated in an electric furnace and taking the temperature of the steel at the moment it ceased to appear visibly red by means of a platinum-rhodium thermo-couple pushed close up to the back of the cylinder end. To remove any possible error due to the temperature of the junction being perhaps not exactly the same as that of the visible end of the cylinder, the calibration of the couple was effected by melting a number of pure substances of known melting-point on a minute ledge on the flat end. For temperatures above the scope of this arrangement the thermo-couple was dispensed with, and the melting of, for instance, nickel and platinum observed through the cells. This is, however, hardly the occasion to enter into details regarding the calibration and the precautions taken to ensure accuracy and some approximation to "black body" conditions.

Determining Temperature by Color

In one of its forms the instrument, Fig. 2, has a stereoscope-like eye-shield to guard the eyes from extraneous light. Instead of two lenses there are two pairs of dye solutions well protected by caps, which also serve to keep the light out. This form is suitable when some particular temperature is required. For instance, the case-hardening temperature is now controlled by employing an instrument like this, with one pair of cells containing dye solution adjusted to 900 degrees Cent. and the other to 925 degrees Cent. If the pots are visible through the 900-degree pair and invisible through the 925-degree pair the temperature is considered correct. There is no need to remove the eyes while the pairs are changed; this is done by sliding the aluminum carrier to one side or the other. For reheating work, and for hardening tools, a single pair is all that is necessary. The hardening temperature is attained as soon as the work appears just visibly red. For double reheating two pairs are of course necessary, e. g., 760 and 880 degrees Cent. The cells can be interchanged and are readily detachable, so one instrument can be used to ascertain any temperature, provided the object be visibly red hot. The actual container is a glass tube less than 1 inch long, with accurately fitting glass ends held together on rubber rings by two telescoping brass tubes. In form the cell is much like a short polarimeter

tube. The caps on the aluminum slides are provided with springs to prevent the cells falling out.

In another form the instrument is adjustable and is either monocular or binocular. In these the dye solution is contained in expansible cells, and a range of absorptive powers obtained by altering the length of the column looked through. The first of this form was made with two thick glass ends and a length of inner tube from a bicycle tire. On squeezing the glass ends together the rubber sides bulge outwards. This is an example of the present form, Fig. 1, the actual container is enclosed in this tube, which is provided at one end with an eyepiece shaped to fit the eye and nose, and at the other with a screw end which lengthens the cell.

The temperature is then given by the scale engraved on the tube, much like a micrometer is read. This form is perhaps not quite so accurate as the form with each cell specially made to one temperature. Within the experimental error from 700 to 1,150 degrees Cent., the temperature in degrees centigrade to which the column corresponds is a linear function of the length of the column of the dye solution selected. In this form the instrument is 3 inches long by 1½ inches diameter and is very handy.

Color Comparison Avoided

This method of determining temperatures is a zero method and is therefore more accurate than one involving a comparison of colors. Furthermore, the critical point occurs when the eye is shaded from extraneous light, that is when the pupil is dilated and the retina is in its most sensitive condition. In judging temperatures by the unaided eye errors are caused by: Extraneous light falling on the eye, the difficulty of remembering close shades of color, errors of judgment in comparing the image of the color observed with a series of mental images of colors previously seen.

All these chances of error are eliminated by an instrument of this kind. No extraneous light falls on the eyes and no recollection is required; the hardener has simply to look through, wait about half a minute until his eyes have become accustomed to the darkness, and then see whether the object is visible as a dark red patch or invisible. Hardeners seem to prefer to use their eyes for telling the temperature, and these instruments provide pyrometric equivalents for limit gages and screw micrometers, and at the same time screen the eyes from the glare and heat of the furnace.

The readings are admittedly dependent on the sensitiveness of the eye; if this varies from person to person, the temperature readings will vary accordingly, being lower the more sensitive the eye. As already stated, these variations do not effect the accuracy momentously, and from actual experiments carried out with this and with another optical pyrometer working under very similar conditions the author feels compelled to believe that the variation in sensitiveness, under the actual working conditions of these instruments, is not nearly so great as might be expected.

If the object be a large one, it is advisable to interpose a perforated screen between it and the instrument. One way to make an observation is to adjust the instrument to a lower temperature than that expected, and then, by sliding darker cells into position, or by unscrewing (if the adjustable form), darken the image until it just ceases to appear colored. The temperatures engraved on the cell or the body of the instrument will then indicate the temperature of the hot body, provided that the conditions of the test are as nearly "black body" as those obtaining when the calibration was effected. Fortunately red-hot iron and steel surfaces have an emissivity of nearly unity, so the error is not large, and can generally be neglected for industrial purposes. Furthermore, any error from this source will not prevent the instrument giving comparative readings under similar conditions, which is all that is necessary in repetition work.

These instruments have been applied with satisfactory results to the heat treatment of steel, carburizing, reheating, annealing, and hardening tools of all kinds. One has outlasted two thermo-electric pyrometers, and it is the author's opinion that a pyrometer which indicates its own temperature

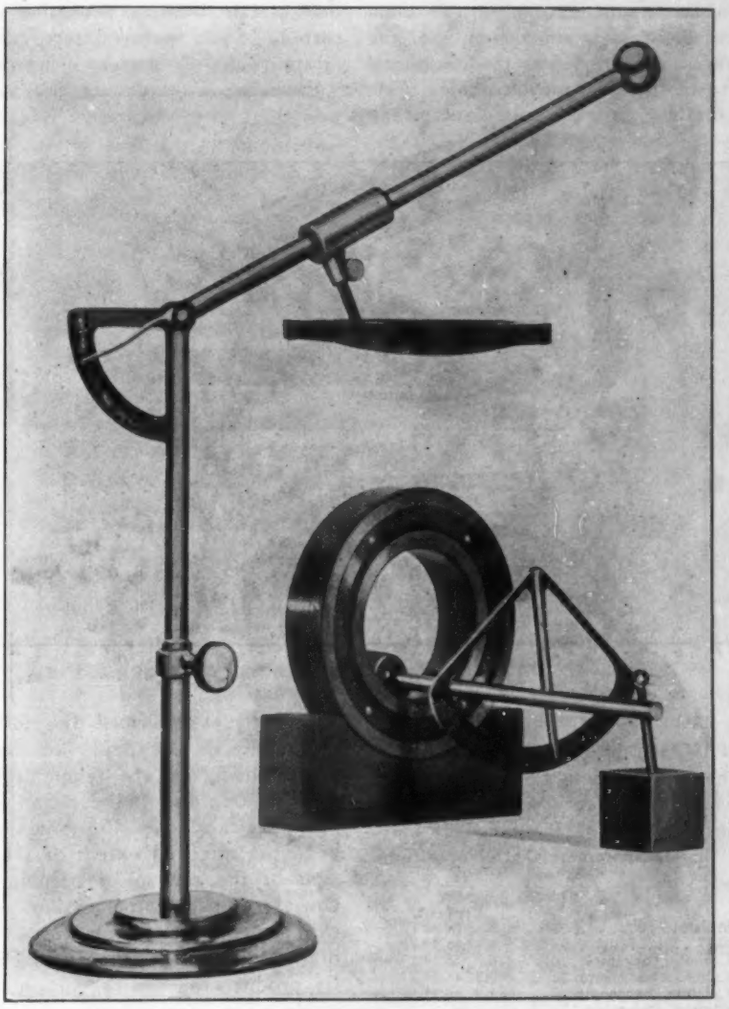


FIG. 5—QUADRANT SCLEROMETERS FOR TESTING FLAT AND CONCAVE SURFACES

may convey some idea of the temperature of the work, but will never be the hardener's friend to the same extent as one of the forms of optical pyrometer which can be focussed on the article itself.

Having provided a simple and effective device for ascertaining the temperature of red-hot bodies, the author set about investigating case-hardening compositions—their nature, mode of action, and effect. Obviously for carburizing to occur the heat must first penetrate to the steel and raise it to the gamma condition; it must liberate and maintain a supply of the carburizing ingredients; the peripheral layers of the steel must combine with, or dissolve, these ingredients; and the carbide must diffuse from the periphery inwards.

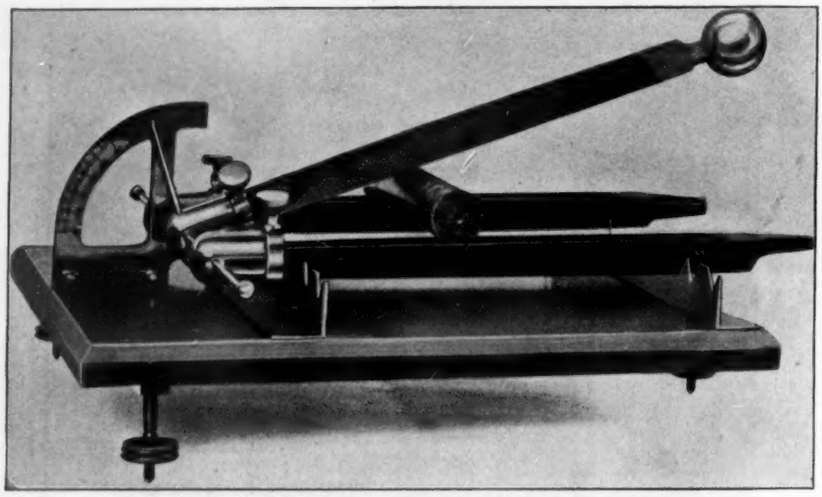


FIG. 6—ADJUSTABLE THREE-FILE QUADRANT SCLEROMETER

The composition of case-hardening materials varies very widely. The following table shows the range of variation in 17 commercial "compositions" tested:

	Per cent.
Moisture	2.68 to 26.17
Oil	0.17 to 20.76
Carbon (organic)	6.7 to 54.19
Calcium phosphate	0.32 to 74.75
Calcium carbonate	1.2 to 11.57
Barium carbonate	nil to 42.0
Zinc oxide	nil to 14.5
Silica	nil to 8.14
Sulphates (SO_3)	trace to 3.45
Sodium chloride	nil to 7.88
Sodium carbonate	nil to 40.0
Sulphides (S)	nil to 2.8

When these experiments were commenced the mixture of barium carbonate, 40 per cent, and charcoal, 60 per cent, suggested by Guillet had not been put forward, and it was usual to use case-hardening compositions once only or perhaps twice. Another drawback experienced in commercial operation, for instance with pots 10 inches high by 10 inches diameter, was the difference in the depth of penetration near the middle and the outside of the pot. Some compositions showed as much as 150 degrees Cent. difference in temperature between the inside and the outside.

The supposition that this loss of carburizing power was due to loss of nitrogenous constituents was confirmed by the author's early experiments. Spent hardening mixture may contain 12 per cent organic carbon (total carbon, less carbon in carbonates), and yet, under similar conditions, have far less carburizing power than fresh material containing less carbon. Such spent mixture gives indication of only traces of nitrogen.

Experiments extending over a considerable time and range of compositions have confirmed the following supposition: The depth of case depends chiefly on the temperature the steel attains and the duration of the hot condition. On these factors depend the rate and extent of the diffusion of the carbon or carbide. The concentration of the carbon in the case depends chiefly on the "activity" of the mixture, or rate at which it or its products part with carbon to the steel. The concentration of carbon in the surface layers may increase or decrease with temperature, but usually increases as the temperature rises and with the time. The duration of the hot condition for a given time of heating depends chiefly upon the permeability to heat of the case-hardening composition.

Comparative depth of penetration has been the subject of a number of investigations, but is so much dependent on factors other than the case-hardening composition that the author has sought for some other test. The one finally adopted is to take a known volume of the composition and ascertain the volume of the "case" that can be got from it without replenishing.

The ratio of the total volume of case to the initial volume of case-hardening material, affords a good indication of the efficiency of the composition, and is not so dependent as a single penetration measurement on other factors such as size of pot, number and size of the articles it contains, loss of heat from furnace walls when the pot is introduced, etc. These exhaustion tests have been made in pots of various sizes, but usually in nickel-plated steel tubes 7 inches long by 1½ inches diameter, and heated in a laboratory muffle for 1½ to 2 hours starting with the muffle hot. A fresh piece of mild steel, such as ⅜ inch round, is used for each heating, and the period is that required to give, at 900 to 930 degrees Cent., a case deep enough for commercial use, viz. 0.015 inch to 0.065 inch. Transverse sections are examined microscopically, and the mixture is considered to be exhausted when ferrite bands can be seen between the pearlite grains at the periphery, that is when the case is unsaturated. With most commercial case-hardening mixtures it is usual to find that the periphery is unsaturated after six or seven heatings of two hours each.

Case-Hardening Mixtures

Incorporating a little potassium carbonate with exhausted charcoal is found to restore at once its carburizing power and make it give up its carbon more readily than the original charcoal. The same is true when potassium hydrate or sodium carbonate is incorporated.

That the carburizing power of such mixtures is due to nitrogenous compounds or cyanides is unlikely. Charcoal soaked in a 5 per cent aqueous solution of sodium carbonate and dried, after three heatings contained, 0.12 per cent nitrogen and no cyanides Yet this gave a saturated case even after the tenth, eleventh, and twelfth heatings.

The author has not fully investigated the nature of the reaction, but comparative tests show that charcoal in an atmosphere of carbonic oxide does not give quite the same result as the charcoal and alkali mixture. Under similar conditions charcoal alone gave an unsaturated case; charcoal and carbon monoxide gave a more saturated but still unsaturated case; and the charcoal and alkali gave a saturated case.

Having found a composition far more permanent in its properties than

any then in current use, the author proceeded to investigate the factors concerned in permeability to heat. Most commercial mixtures consist of or contain a large proportion of small particles which it seems reasonable to expect will block up all the interstices and prevent the free passage of heat, for it has been shown that the heat conductivity of insulating materials depends chiefly on their air spaces. To test this point granular charcoal was employed, and two model case-hardening pots were made 5 inches high, 3.7 inches diameter, and 0.04 inch thick. They were made of sheet steel and welded together. One contained the charcoal under investigation, and the other was used empty. A thermometer bulb was placed at the centre of each pot and the apparatus placed in an oven at 180 degrees Cent. Two striking points are brought out by these experiments, the arrest of temperature at the center at about 100 degrees Cent. while moisture is being driven off, and the effect of size of grain, and particularly of dust, upon the duration of the arrest.

An Improvement in Tempering

The use of hot tallow and lead for tempering is of course well known; but the application of an electric welder, Fig. 4, which, the author believes, was originated by V. A. Holroyd, presents some novel and advantageous features. It is particularly useful for local softening or tempering and unlike tempering in tallow, the core of the article is left softer than the outside. This is specially advantageous for case-hardened articles. The operation is a very quick one, and the surface is left quite clean.

So far as the author is aware, very little work has been done to provide commercial means for testing the suitability of case-hardened articles. The practice of examining test-pieces carburized, heat treated, and hardened along with each batch is of course sound as far as it goes. The Shore scleroscope and Brinell test have their spheres of usefulness. But still the file is the instrument most used, and perhaps rightly, for it does give an idea of the resistance the surface of the article offers to abrasion under pressure, which is what most articles are case-hardened to withstand. This and the Brinell test are, we believe, the instruments in commonest use for testing case-hardened work and test-pieces.

For small articles a modified center punch is particularly suitable for rapidly getting a working idea as to whether the case is above the minimum permissible depth. It is an ordinary 6-inch Brown & Sharpe automatic center punch to which we have fitted a screwed-on container for holding a ⅛-inch bicycle ball, as shown in the upper illustration, Fig. 5. The hard point has been removed and the container screwed on in its place. The ball protrudes just sufficiently to prevent the container coming into contact with the article under test. This is very useful for large as well as small articles, and its readings appear to refer more to the case and less to the core than those obtained with a Brinell testing machine.

Having secured a considerable improvement in both permanence and permeability to heat, it remained to ascertain whether this "composition" imparted a suitable percentage of carbon and gave uniform results from day to day. W. T. Flather has made a great number of determinations of carbon in the successive layers of the case and was good enough to carburize some bars of Ubas steel in his standard pot, and under his standard conditions, but using the dust-free charcoal impregnated with soda ash, three parts used to one part fresh already referred to. These bars were ⅝ inch diameter and 6 inches long, and were carburized four hours at 925 degrees Cent. Successive layers, 0.0025 inch thick, were turned off all along, the end half inch being left on to avoid end effects. Some of the carbons were determined by combustion, and the others by the color test, using the former as standards. The results of the carbon determinations are to be found in the following table:

	Carbon per cent.
Surface layer	1.050
2nd layer	1.020
3rd "	1.015
4th "	1.010
5th "	1.000
6th "	0.950
7th "	0.880
8th "	0.840
9th "	0.830
10th "	0.810
11th "	0.750
12th "	0.695
13th "	0.655
14th "	0.630
15th "	0.595
16th "	0.585
17th "	0.535
18th "	0.505
19th "	0.480
20th "	0.440
22nd "	0.395
24th "	0.365
26th "	0.330
28th "	0.315
30th "	0.305
32nd "	0.305
34th "	0.275
36th "	0.255
38th "	0.227
40th "	0.205

The even gradation of the carbon content from surface to core is noteworthy.

In a test on a commercial scale, extending over 29 days, test-bars 1 inch diameter were carburized along with ordinary work at 900 to 925 degrees Cent., the mixture being replenished once or twice a week to make good the inevitable waste. The bars were cooled in the pots, and the surface layer turned off as above and analyzed, with the following results: New mixture, 0.967 per cent carbon; end of first day, 0.909 per cent carbon; end of 4th day, 0.981 per cent carbon; and at the end of 29th day, 1.06 per cent carbon. The author considers 0.9 to 1.1 carbon satisfactory, and preferable to less than 0.9 per cent. The cementite does not appear to form laminae unless the percentage of carbon is greater than 1.05; and for work that has to be ground, a slight degree of supersaturation at the surface is considered necessary. Charred leather at 1,000 degrees Cent. imparts about 1.3 per cent carbon, at 925 degrees Cent. about 1.2 per cent carbon, and Guillet's composition, barium carbonate, 40 per cent, and wood charcoal, 60 per cent, at 925 degrees Cent. about 1.2 per cent.

These analyses disclose the average carbon content of the layer in question, but they do not give any evidence of uniformity. It is quite possible that such large grains may produce local inequalities in the degree of carburization. To test this point, the author has employed the coloring solution, also the scleroscope and sclerometer referred to later. Even when the case on 1-inch bars of Ubas steel was not more than 0.012 inch deep, the color developed showed no indication whatever of local paucity of carbon.

An Improved Sclerometer

On account of the variable element in testing resistance to abrasion with a file by hand, the author sought to devise means for measuring the friction under a given load. A pair of "scissors" with files in place of shears was found to be cumbersome, and the weight of the article introduced variations according to the position the scissors were held in. Small flat articles can be placed on the top of a file, and the hardness gaged by raising one end of the file and observing the angle when the article slides.

This led to placing the article under the file so that its weight causes relative motion, which motion ceases, if not too rapid, when the frictional forces are great enough. This instrument is for testing round surfaces. A soft bar holds the top file up so that it makes an angle of about 70 degrees with the bottom one. The actual angle is indicated by figures engraved on the slotted quadrant. A

(*Continued on page 856b*)

Standard Machine Tool Motors

An Analysis of the Problem Showing What Features of Electric Motors Can Be Standardized

BY CHARLES FAIR

DURING past years much progress has been made in the standardizing of certain machine parts, with results advantageous both to the machine manufacturer and user. For a long time it has been recognized as desirable at least on the part of a number of the machine tool builders that something be done towards standardizing certain motor dimensions, speeds, etc., for machine tool drive. For the past five or six years attempts have been made to standardize certain dimensions and speeds for machine tool motors, but these attempts have failed for various reasons. It would be of little use to analyze these past failures. Unquestionably there should be first of all a better understanding on the part of the machine manufacturer and the motor manufacturer of each other's difficulties; and much work is essential before material progress along the line of standardization can be accomplished. With this in mind, I have prepared an outline which I think fairly presents the situation from the view-point of both sides, and which must be considered if results are to be obtained. This outline is published herewith.

- **Speeds....**
  - Constant
    - AC
      - Full load
        - Cycles
        - Phase
        - Voltage
      - Synchronous
        - Squirrel cage
        - Slip ring
        - Internal rest
    - DC
      - Full load
        - Voltage
        - Shunt
        - Compound
        - Series
      - Light load
  - Variable
    - Adjustable
      - DC
        - Voltage
          - Shunt
          - Comp.
          - Series
      - AC
        - Brush shifting
          - Shunt characteristics
          - Series characteristics
        - Multi-speed
          - Constant horsepower
          - Constant torque
        - Slip ring
          - Multi-speed
    - Variable
- **Shafts....**
  - Diameter
  - Keyway
  - Length
  - Gear
    - Involute
      - Steel
      - Rawhide
    - Herringbone
  - Chain
    - Bevel, worm [thrust]
  - Coupling
  - Belt
- **Frame....**
  - Bottom of feet to center line of shaft
  - Shoulder on shaft to center line of feet
  - Overall dimension of feet
  - Drilling of feet—dimensions and sizes of holes
- **Drive.....**
  - Gears
    - Peripheral speed
      - Normal for constant
      - Maximum for adjustable
        - Cost, size
    - Minimum number of teeth, pitch, face, bore
  - Chain, coupling, belt
  - Reversing, non-reversing, slow-down, brake
    - Dynamic
    - Solenoid
    - Mechanical
  - Range of speed required
    - Cost
    - Size of motor
  - All geared drive for constant speed
  - Balance of rotating parts
  - Change gears—motor speed overlapping
- **General...**
  - Uniformity marking motor terminals
  - Uniformity control diagram
  - Protection of live parts
  - Covers for end shields, etc.

It could not be expected that the electrical manufacturers would change existing standards of motor dimensions or speeds, nor do I believe it would be desirable; but I see no reason why if the machine manufacturers in conjunction with the motor manufacturers will give the subject the consideration it warrants, and do their part towards bringing about a better understanding, the motor manufacturers in turn cannot incorporate, at least in part, some of the dimensions and the speeds when bringing out new lines of motors. Obviously, it would be just as impossible for the various motor manufacturers to design their motors to a single set of dimensions as it would be for the machine manufacturers to design their machines to a single set of dimensions. Notwithstanding this, however, much can be done to improve the situation. The American Society of Mechanical Engineers, through its secretary, Mr. Rice, has offered to co-operate and is willing to do everything within its power to help in this question of standardization, but before going further it might be well to look at the outline above referred to that we may have a better understanding of the subject as a whole. For the sake of convenience, I have divided the outline into five parts, namely, speeds, shafts, frame, method of drive and general.

Motor Speeds

Under the heading of speeds you will note from the outline that there is an almost endless number of combinations available, but from this great variety certain speeds should become the logical ones for the majority of drives. The direct current constant speed shunt motor speed, for instance, might be that of the alternating current 60 cycle motor. Alternating current and direct current motor speeds should be given in terms of full load or possibly in terms of both no load and full load. It is, of course, understood that the cycles fix the alternating current motor speeds, except as modified by slip, etc. Adjustable speed motors would naturally be higher in speed on the highest speed than a constant speed motor, on the theory that the adjustable

(*Continued on page* 856*c*.)

A paper by Charles Fair, of the General Electric Co. read at the April meeting of the National Machine Tool Builders' Association at Worcester, Mass.

Earning More Money For All

What Can Be Done to Increase Incomes of Employers and Employes? —Change of Methods Necessary

BY J C SPENCE

THE record of the recent past, and the known evidences as to the immediate future show that if the American machine tool industry is to compete for the best class of workmen, there must be a change in our methods. Competition with Europe and with each other precludes the possibility of any great increase in the selling prices of our products.

The changes, then, must happen within our organizations; we must get more salable goods per dollar of investment, and this result must be attained, not by a decrease in the earnings of all concerned, but by an increase, else we will gradually lose the best of our men to such other industries as have, at present, a larger margin of profit. This movement has already made inroads into the field of good machinists, and every one of you is familiar with the statement that "we cannot get the kind of man that we could some years ago." This lack of good men is, of course, not due entirely in our line, to the fact that other industries are offering better opportunities, but is more or less influenced by the growth of industry in general being faster than the supply of trained men would warrant. Nevertheless, it is a known fact that one industry in particular is taking from us many of our brightest young men, and is taking them almost entirely because of wages.

Granting then, that conditions will remain practically as they are, the only method by which we will keep the personnel of our particular industry in the highest class is by the offering of greater wages. The mere act of holding a job has ceased to be the all-important inducement.

Whenever the word "efficient" or "inefficient" has been used as applying to our line of work, the natural tendency has been for all minds to turn to the shop end of the business, especially to the man who runs a machine. Practically all of the illustrations by means of which our eminent experts have arrested the attention and gained a permanent lease of the ears of managers and boards of directors, have had to do with such perfectly awful incidents as a shaper tool taking a 5-inch stroke when a 3⅝-inch stroke would have been sufficient.

I hold no brief for the man who cuts air when he should cut metal, but to my mind it is no more than right that we should first look to ourselves to see wherein we fall short of the mark of 100 per cent. If the workman is not efficient, just what is our share of the cause of his inefficiency?

First, let me say, that it is my firm belief that the large majority (if I were to state a percentage I would say 90 per cent) of all machinists employed by the Machine Tool Builders' Association are endeavoring to give you an honest day's work. That they do not give you more work than at present is largely your fault—so much your fault that it is going to take the whole of your attention to certain details before you can induce your men, and hence yourselves, to earn more money.

I am saying this from a mind that only a comparatively few years ago looked at the workman's side, only, of this question. I am not so far away from the operation of a machine that my memory has become dulled to what went on when I was trying to produce against obstructions allowed to stand in my way by my foreman and by his superiors.

The metal cutters, or chip makers, on the simpler class of work, may be assumed to be fairly efficient in most of our shops.

It has been a comparatively easy matter to set standard times or prices on these operations. There is still a good field for improvement in the making of drawings, especially for the workman's use. I'll venture to say that in every one of our shops today there are blueprints that the "old man" himself would not recognize as showing a part of his own inventions, if someone should cut the title corner off, and as for settling where the machining should begin, he would have to lose a good many minutes in study. Even the simpler drawings are a puzzle to the beginner and the foreman cannot be in all places at once. We should point out, on our drawings, by copious use of English and by means of routing sheets, just what the workman is expected to do.

I have not had the pleasure of visiting all of your shops, but the most of those that I have seen are open to this criticism. We are all drifting along, to some extent at least, in the old way of leaving a workman to his own initiative to find ways and means of doing a great share of the operations.

The draftsman who learns to make drawings with the idea of saving time in the shop, gradually makes of himself an engineer in the true sense of the word, because in order to tell how a piece should be made, he first has to learn by consultation with those who do know. He is inducing himself to earn more money.

The foreman, who is fortunate enough to have his blueprints come to him in such form that the more intelligent of his men need little personal instruction and supervision, has more time to devote to the weaker members of his gang and his department output is higher—consequently, his own value increases.

Right in line with this plan, I recently tried an experiment that is interesting, because it is illustrative

Quacks and Others

"I do not wish to be understood, when I mention the stop watch, as not agreeing that oftentimes facts can be learned, and gains made through the medium of so-called 'efficiency' workers, who are themselves perhaps incapable of performing the operations, but who are intelligent observers. What I do mean is that, personally, I believe the greater savings are to be made by having a skilled man study the job from an inventor's standpoint rather than from that of a recorder or historian. All interferences with production are not evident to a mere observer. Most of them hark back to the design or to conditions imposed by the relations of a given piece to others in the same machine.

"The 'Efficiency' movement, like many other great movements, has its quacks who seize the time of unrest to play upon the credulous ignorant. But every one of us should be thankful for the impetus given to our minds by the crusade definitely started by F. W. Taylor."

Presented to the National Machine Tool Builders' Association at the Worcester meeting. The author is superintendent of the Norton Grinding Co., Worcester, Mass.

of exactly what is going on in many shops, and is causing the loss of a lot of money.

A quantity of a certain small piece was sent to us by another firm to be ground. We had quoted on the work and there was a price we had to meet. As usual, in such cases, before letting the work start in the shop, we sent along with the pieces a routing sheet, which told how many pieces per hour we had estimated to be a fair production. The pieces were produced inside of the time limit and the net cost per piece was 1½ cents.

Several months later, a lot of the same pieces came in, and these were put into the shop and ground by the same man, but without anything to tell him what was expected of him. The second lot cost two cents per piece.

Not in Business for Himself

Now the operator was not dishonest. I do not believe that he intentionally held back. He simply was not in business for himself. He would have produced those pieces for 1½ cents if there had been any means supplied for concentrating his mind on the job. Even if he had run into an obstacle that he couldn't overcome, he would have called for help, quickly, in order to protect his own record. As it was, the time drifted by without his having a very clear idea of anything in particular.

You've got to get the man interested, and there's only one way—put him into business for himself. How this is to be done, whether by premium or by piecework, matters little, provided you see to it that more product means more wages. There is just this much about it—those of you who stick to a straight day work system, unless you devise ways of periodically rewarding increased efficiency, will lose your men to the shops that succeed in putting every man into business for himself.

I know of a shop that has reduced the cost of erecting its machines by doing two things: First, giving up the old slip shod method of starting to erect before everything was ready, and second, by putting the assemblers into business by giving them a generous bonus for speed.

An incident reported to me by the foreman of that job shows how it works out. He overheard one of the assemblers using rather forceful language to a truckman. It seems that the truckman had been sent to the stores to get a certain mechanism that was to be the next one to go onto the machine. He arrived at the stores at about six o'clock, and, as the mechanism was covered with an anti-rust compound, the stores boy, not wishing to have to again wash his hands, put him off with some excuse. The truckman went back with an empty truck and the conversation overheard by the foreman was the result. I cannot, for obvious reasons, quote verbatim what he told the truckman, but the gist of it was to get back to the stores with word that the mechanism had to be at the machine, ready to be used at seven o'clock the next day, or something unpleasant would happen to both the truckman and the stores boy. That assembler was in business for himself.

Another incident.—A lot of gears were being machined at the turret lathe. The operator could, ordinarily, make good pay at 10 cents each. The foundry had evidently made the gears of iron that was intended for larger work. They were hard. Under the old methods, it would be only an accident that this fact would be discovered, before the job was completed. In this particular case, the workman appealed to his foreman who took the matter up with the superintendent. The result was that the foundry acknowledged its error, paid for the amount the operator ran behind, and the expense was put where it belonged. That man was in business for himself.

Burden Owners Carry

"If all of your workmen could know, today, the burden that shop owners have been carrying and are carrying in the problem of how to keep their men at work during this period of depressed business, there would be a great many men who would not stop to listen to the agitator, when he starts in again. That your men do not know such facts as this, is your misfortune, and it is my belief that you have every right to uncover such facts and especially to educate your men to such an understanding of business conditions that they will cease to listen seriously to many of the wild statements made on the street."

An operator noticed that some bars in a lot of tool steel, machined much more rapidly than others. His insistance on having all the bars good ones led to a thorough investigation of the whole question, and the formulation of specifications on tool steel that now enable that firm to form tool 3-inch diameter tool steel bars with tools 3 inches wide at a surface speed of over 100 feet per minute.

The firm, from whose experience these incidents have been cited, believes that the best way to put a man into business so that he can share profits on each job he does, is to have a rate setting department that is made up of good operators, under the leadership of a man who is, himself, capable of taking hold of any productive job in the works. It is almost always found to be a fact that a careful study of a job, not by the stop watch, but by actually doing it, leads to improvement. Sometimes there is only a slight gain. In other cases, the time has been reduced to one-third of its former time.

The rates are set on the principle that since it has been found possible to reduce the cost and the concern was satisfied with that cost, before this discovery, then the new rate can be placed well above what actually can be done for. This is contrary to the old spirit of management, but is right in line with what most machine tool men at least believe, and is the only way you can get your men into business for themselves.

Trained Observers Needed

In this connection I do not wish to be understood when I mention the stop watch, as not agreeing that oftentimes facts can be learned, and gains made through the medium of so-called "efficiency" workers, who are themselves perhaps incapable of performing the operations, but who are intelligent observers. What I do mean is that, personally, I believe the greater savings are to be made by having a skilled man study the job from an inventor's standpoint rather than from that of a recorder or historian. All interferences with production are not evident to a mere observer. Most of them hark back to the design or to conditions imposed by the relations of a given piece to others in the same machine.

The "Efficiency" movement, like many other great movements, has its quacks who seize the time of unrest to play upon the credulous ignorant. But every one of us should be thankful for the impetus given to our minds by the crusade definitely started by Mr. F. W. Taylor.

The obtaining of the benefits of this common sense scheme need not cost anything. In fact, it can be made to pay almost from the beginning. One good man can do enough for a group of men, in so short a time, that the extra production of the group will pay not only for the money spent on them, but also for further work with other groups. The scheme, properly conducted on a common sense basis, without frills, soon is compounding its gains. Such a movement, to be successful, requires the hearty backing

of the management, for there will always be men in every organization, perfectly honest in their views, but who are unable to see beyond the tips of their own noses, when it comes to making a change from the established order of things.

A management that will accept, without considering it a personal affront, the statement that it is not as efficient as it could easily be made, and at the same time be so constituted mentally that it is eager to share with the producer in any saving that may be made, will easily find ways to reduce cost, and need have no fear of either being unable to get good men or to hold them loyal.

Men are more often careless through ignorance than by nature or intent. The man who spoils a piece of work knows that he has destroyed value, but to him the time lost is usually the item that appears to be the most important. Men should be educated in the total value of the goods they handle. They should know the cost of materials and approximately the shop burden.

I know one superintendent who has adopted the system of having all spoiled work reported to him on a card that states the fault and the number of pieces spoiled. Whenever the case is of enough importance to attract his attention, he makes it the excuse for a friendly talk with the man who did the job. He talks the affair over in a way that brings out both sides of the case. Before he lets go of that incident, he has taught that man a whole lot about what it costs to carry the burden of a business. He has done more good than any "call down" would do, and he has strengthened the workman's loyalty to the firm, and this, without saying, includes a determination to spoil no more if he can help it.

Discharge should be the last resort, and a frequent use, under ordinary conditions, of the power of discharge, for any reason other than the lack of work, is the sign of a poor shop management. Under the management that finds its main corrective in discharge, the new man will be at a still further disadvantage, because he will not have had the experience that caused the downfall of his predecessor.

The Foreman

Now and then you will find a foreman who is a natural born business man, but this kind is rare, as foremen are usually promoted to their positions because they are good workmen, and not because of the other qualities that a foreman should have. There is a lot of difference between being a good workman and being a good executive. Most foremen have no definite idea of the cost of anything, except net labor, and it is not their fault, either. Management rarely interests itself in a foreman to the extent of trying to make a real business man out of him. Yet the returns are well worth the effort.

Just start a scheme whereby your foreman really runs his own department, and knows exactly where every cent was spent, for which he was responsible, and you will find a most interested and watchful lot of men. You will find that having the entire list of officers on the alert for economy is away ahead of trying to do all of the worrying yourself about the time the cost department reports the facts which is several weeks after the damage was done.

At the Norton Grinding Co., we keep an account against each foreman and gang boss, of all of the expenses for which he is directly responsible, that is, repairs and replacements, supplies, non-productive labor, spoiled work, etc. Such items as taxes, rent, power, etc., are, of course, not considered, as he has no direct control over them.

The total of his expenses divided by the total of his productive labor, gives what we, for the sake of comparison, call the overhead of his department. At the end of the month he is given by the cost department all of his supply requisitions with the costs marked in, and all through the month, if another foreman does for him any non-productive job, such as repairing a machine or grinding a cutter, a duplicate of the time card is sent to him with the total money cost showing. This system has aroused more interest among the foremen than any scheme we have yet found.

One foreman found that he was being charged $10 per week for trucking, the truckmen, up to that time, being responsible to the head inspector, and responding to calls much the same as the bell boy plan in a hotel. The foreman kept careful record for a few weeks, and then made the announcement to me that his trucking was worth only $6 per week, and that he didn't want to pay $10 for it. The result was that we took one truckman away from the inspector and put him at productive work in the casting department, and the foreman hired a cheaper man to do simple productive work some of the time and trucking when it was needed.

Another foreman came to me with a milling cutter and said: "We make cutter grinders for sale. How much time would you tell a customer that it would take to grind this?"

Interest the Men

I knew something was up, so I was conservative. My estimate was that it ought not to take over two hours. He, thereupon, produced a charge by another foreman of 16 hours for the job. We both made a trip to see the other foreman, with the result that the charge was reduced to two hours, which all agreed was ample. The foreman who had done the job was charged with 14 hours of spoiled work, and the grinder operator was given his notice because his foreman said this was simply the climax of several such incidents, and he had failed to show any interest.

Even second-hand belting suddenly assumed great importance. I did not, at first, foresee that hairs would be split so fine, but it did not take long before a foreman wanted to know what became of a certain belt that was taken out of his department and replaced by a new one. I told him the good part of it would be spliced to another piece and used again. He wanted to know if I didn't think he ought to have credit. So now, when we take an old belt out, if the man in charge of belting says the bulk of it can be used again, after cleaning and repairing, we credit the department with one-half the price of a new belt. When we use that belt again, we charge the department getting it with one-half the price of a new belt.

Cotton waste is down to one-quarter pound per week per man using waste, and belting is down to $18 per month, average, for the whole shop, where there are 1,160 belts in almost constant use every working day.

The foremen are enthusiastic over

Some Salient Points

"The superintendent should never be too busy to take care of any matter that the foremen or workmen think is important, whether or not it is firm's business or personal, and he should be a man in whose word the men have confidence."

"We are all drifting along, to some extent at least, in the old way of leaving a workman to his own initiative to find ways and means of doing a great share of the operations."

"I hold no brief for the man who cuts air when he should cut metal, but to my mind it is no more than right that we should first look to ourselves to see wherein we fall short of the mark of 100 *per cent. If the workman is not efficient, just what is our share of the cause of his inefficiency?"*

the scheme. One foreman said: "Sure, I like it. It teaches me so much about my job that if you don't treat me right I can go to someone else and tell him for just how much I can run a department, including my own wages."

That is just the the position we want him to be in, because we, being on the inside, know all about him, and ought to be able to keep him, if we consider him worth keeping. If, by poor judgment, on our part, he leaves and is really worth more, then we can rejoice with him that he has benefited.

The Superintendent

The superintendent should never be too busy to take care of any matter that the foremen or workmen think is important, whether or not it is firm's business or personal, and he should be a man in whose word the men have confidence. His training and his actions should be such that the men will know that he is not asking for anything unreasonable, or that he would not do himself. He must be an enthusiast in his business. He must be a boy with the boys; in fact, he must never forget to be a boy at heart. All first-class enthusiasts are. He must always be on the lookout for good qualities in men. He must campaign for loyalty, a shop's best asset, just as the nation, through the public schools, campaigns for patriotism, for both are the result of plan and not of accident. Loyalty, like patriotism, is spontaneous only in times of intense emotion. It has to be created and fostered by well laid plans that have for their fundamental principle the giving of value for value received.

The superintendent must have the co-operation of the management in teaching the so-called "non-producer" that the business of capital is to make dividends, and that the only excuse for his particular "non-productive" existence is to help "productive" labor to make more chips or to get something assembled faster or better, and that the closing of his day's duties at a certain hour, is merely an unimportant incident instead of being the great event that tradition has made it.

Before we leave this subject of loyalty, it seems necessary to me that I should broach a subject that is usually tabooed in open meeting, but a subject that, to my mind, should be discussed openly, as it has to do directly with the earning power of all workmen who become infected. I refer to unionism as it is now conducted.

What are we doing to combat or counteract it?

Practically nothing that will have a permanent effect. The opposing of strikes by means of strike breakers and by any other combative means within our power, is simply the expedient of necessity and is costly to both sides.

We must get at the question through the education of the individual. Practically nothing is being done in this line. The machinist who knows absolutely that there is nothing for him in unionism as it is today conducted learned it only by costly experience. It is going to take too long for all of your men to be educated by that method.

The manufacturer has thus far stood between the union and the public, and has been discredited by the public because the public has been left practically ignorant of the employer's side of the question. The other side of the question sells more newspapers, the people hear all about the one side and many untruths about the other.

Now, I know enough of the owners and managers of the firms in the National Machine Tool Builders' Association to state that there is not a fairer-minded lot of men on earth in their dealings with the employed. If all of your workmen could know, today, the burden that shop owners have been carrying and are carrying in the problem of how to keep their men at work during this period of depressed business, there would be a great many men who would not stop to listen to the agitator, when he starts in again.

That your men do not know such facts as this is your misfortune, and it is my belief that you have every right to uncover such facts and especially to educate your men to such an understanding of business conditions that they will cease to listen seriously to many of the wild statements made on the street.

For instance, in Fitchburg, during the machinists' strike, the daily papers quoted a union leader as saying something like this: "You fellows average to get $2.50 a day. You average to produce $10 a day. The man in the automobile gets $7.50 a day out of each of you."

Now, that statement was allowed to stand, and I believe that many of that man's hearers accepted it as being practically true.

Those of you who can remember back, if you were so fortunate as to have the privilege of learning a trade, can also recall a time when that man would have arrested your attention, and if you had not followed him, it would simply have been because you had other ideas about what you were after, and not because his statement appeared to you to be so very far wrong.

The employer has not taken the trouble, through well planned intelligent means to teach the workman that net labor is not the great item in an industry. He thinks it is a serious sin to mention the word "overhead" outside of the office. He has not actually proved to anybody, but himself, that if a machinist gets $2.50 per day and only produces $10 of salable goods in the heavy lines of machinery, such as are made in Fitchburg, that in a good many cases the "man in the automobile" would lose money.

This kind of education should be spread broadcast. It is not a dream to think that it would be good for a high school boy to know something of the overhead of education and of business just as the engineering schools, notably the Worcester Polytechnic Institute, are teaching it.

Winning Over Prejudice

Trained men should address workmen, in front of the shops, if you like, and the public at every possible opportunity, in an endeavor to clear the workman's mind of the ignorance that continually works against his own advancement. Employers already issue several very good papers for this purpose, but those papers are confined. in their circulation, almost entirely to men who already believe in that side of the question. These papers should be put into the hands of every man in your shops, and would do a whole lot of good in the hands of men outside of our own calling. The printed matter should be followed up by intelligent, enthusiastic effort to convert men to the right way of thinking.

Even the Bible, as a book, would never have Christianized any country, if it had not been for the enthusiasts behind it.

Men must be taught that although they have rights every right entails a duty to the community, and the service must be rendered before the right can be justly claimed.

It's about time that the sane men

How to Arouse Interest

"Just start a scheme whereby your foreman really runs his own department, and knows exactly where every cent was spent, for which he was responsible, and you will find a most interested and watchful lot of men. You will find that having the entire list of officers on the alert for economy is far ahead of trying to do all of the worrying yourself about the time the cost department reports the facts, which is several weeks after the damage was done."

of this country who hire labor, took hold of this question in an honest endeavor to get together with the sane men of this country who have labor for sale, instead of leaving this important duty to labor leaders who would lose their jobs if they ever really did succeed in doing what they claim to be trying to do—that is, get us together.

How Molybdenum Steel Corrodes

(*Continued from page 834.*)

forcibly the necessity of determining the corrosion of iron and steel under conditions closely similar to those which the metal will be subjected to in practice.

The company will erect two buildings of brick and steel construction, 120 x 240 feet each, and a foundry with a 25-ton cupola. About 300 tons of structural steel will be required. Construction will be started at once and it is expected the buildings will be ready for occupancy in six months.

Table II.

THE CORRODIBILITY OF MOLYBDENUM STEELS

Steel No.	Carbon, per cent.	Molybdenum, per cent.	Tap water (46 weeks). Loss in weight.	Tap water (46 weeks). Corrosion factor.	Salt water (42 weeks). Loss in weight.	Salt water (42 weeks). Corrosion factor.	Wet and dry (14 weeks). Loss in weight.	Wet and dry (14 weeks). Corrosion factor.	0.05 per cent acid (17 weeks). Loss in weight.	0.05 per cent acid (17 weeks). Corrosion factor.	Mean corrosion factor.	0.5 per cent acid (10 weeks). Loss in weight.	0.5 per cent acid (10 weeks). Corrosion factor.
1[1]	0.14	0.0	0.6478	100	0.6493	100	0.6267	100	0.5906	100	100.0	2.8781	100
2	0.195	1.030	0.6184	95	0.5252	81	0.6500	104	0.5888	100	95.0	2.7990	97
3	0.246	2.176	0.6598	102	0.6494	100	0.7968	127	0.5314	90	105.0	2.8906	100
4	0.190	4.110	0.6540	101	0.6684	103	0.8234	131	0.5834	99	108.5	2.9872	104
5[1]	0.40	0.0	0.6470	100	0.7292	112	0.3732	59	0.6182	105	94.0	2.9677	103
6	0.445	1.054	0.6200	96	0.6846	105	0.7090	113	0.5600	97	103.0	2.9868	104
7	0.442	2.181	0.6398	99	0.6102	94	0.9776	156	0.5588	95	111.0	2.9726	103
8	0.487	4.009	0.6840	106	0.6436	99	0.9030	144	0.5040	85	108.5	3.0736	107
9[1]	1.04	0.0	0.6616	102	0.7660	118	0.2756	44	0.6312	107	93.0	3.1117	108
10	1.215	1.096	0.6628	102	0.7016	108	0.7224	115	0.6044	102	107.0	3.1557	110
11	1.210	2.109	0.6790	105	0.6812	105	0.7900	128	0.6046	102	110.0	3.3294	116
12	1.060	4.019	0.6862	106	0.6272	97	0.9486	151	0.6046	102	114.0	3.1286	109

Smelting Titaniferous Ore

Extensive experiments with the smelting of titaniferous iron ore were resumed the past week at the Cedar Point furnace at Port Henry, N. Y., after a month's interruption, during which the stack was banked. The trials with the original ore mixtures, which contained a small portion of titaniferous ore, and of the pig iron manufactured from them, having proved favorable, it is stated by those interested that larger proportions of the titaniferous ore will now be put through the furnace.

While no final developments or findings have been made for public announcement, it is stated that the pig iron made thus far from the titaniferous ore has proved very satisfactory where used by foundrymen. The effect of the titanium in the iron, as best it can be discovered, tends to moderately increase the strength of the casting and causes it to take a smoother finish when machined. It has been found that very little of the titanium carries through to the casting. It also has been developed that it requires more complete chemical tests than ordinarily pursued in analyzing pig iron, to determine the titanium constituent in the furnace metal.

The purposes of elaborate experiments now being conducted at Port Henry by the McIntyre Iron Co., New York City, are to establish the commercial value of the extensive titaniferous ore deposits of the company in the Lake Sanford, New York, district, and to demonstrate the marketable quality of pig iron made from such mineral.

Bollinger Bros., Inc., Newell, Pa., manufacturer of coal tipples, coal washers and coal-handling machinery, has purchased five acres in Economy, Pa., on Pennsylvania railroad tracks.

Thomas Iron Co.'s Bond Issue

An issue of $1,000,000 of six per cent first mortgage 20-year gold bonds recently authorized by the stockholders of the Thomas Iron Co., now is being offered for general subscription. Of this issue, $600,000 is to take up floating indebtedness and to provide working capital for the company and $400,000 is to be reserved in the treasury to be used only for additions, extensions and permanent improvements of the various plants. The bonds of this latter amount are not to be issued until a further authorizing vote of the stockholders is taken. It is advised that the improvements contemplated by the company at the present time are not extensive. The No. 8 furnace at Alburtis now is being repaired and is being prepared for relining. It is proposed to reline and repair the No. 3 furnace at Hokendauqua and to make some changes in the handling of slag and of pig iron. The mortgage securing the new bonds, it is stated, will cover the four plants, consisting of three Hokendauqua furnaces at Hokendauqua, Pa.; two Saucon furnaces at Hellertown, Pa.,; two Lockridge furnaces at Alburtis, Pa., and one Keystone furnace at Island Park, Pa.; the Richard Mine, at Wharton, N. J., and other mining properties in Lehigh and Northampton Counties, Pa.; farm lands in Lehigh and Northampton, Pa., and stock of the Catasauqua & Fogelville Railroad Co. and of the Ironton Railroad Co., making a total estimated value of $4,207,700.

It is stated that the earnings of the railroad stock held by the Thomas Iron Co. amount to about $100,000 per year.

Talked on Sand Blast

H. D. Gates, of the Mott Sand Blast Department of the De La Vergne Machine Co., New York City, addressed the Associated Foundry Foremen of New York and vicinity, at the Grand Union Hotel, on April 25, the subject of his remarks being "The Sand Blast from the User's Viewpoint." The next meeting of the association will be held on May 23 at the Murray Hill hotel. The speaker will be Prof. Heggie, of Stevens Institute of Technology, who will present a paper on one of two subjects, "Cupalo Temperatures," or "Liquid Pressure in Molds and Cores."

The association plans to wind up its season in June with a dinner, to which will be invited all the speakers who addressed the meetings during the year. D. C. Wilson, of the De La Vergne Machine Co., New York, is president, and W. K. Callow, of Debevoise-Anderson Co., New York, is acting secretary of the association.

Roads Need More Money at Once

Said Attorney Patterson to Commission—Charged That Increase Proposed Would Be Heavy Burden on Low Grade Commodities

Washington, May 5.—Arguments on the first of the two main questions in the so-called 5 per cent advance rate case of the eastern railroads having come to a close last Friday afternoon, speculative Washington is indulging in idle guesses as to when a decision may be expected. Chairman Harlan, of the Interstate Commerce Commission, in a statement issued some months ago, said there appeared to be no reason why a decision could not be rendered before the summer recess. That is all that anyone does or can know about the matter.

The question just disposed of deals with the adequacy or inadequacy of the present rates of railroads in official classification territory. The second question, proceeding from the assumption that the revenues are inadequate, deals with the way in which they might be raised. If the present rates were found to be adequate, that would of necessity end the case in so far as it pertains to an advance. If the revenues are found to be inadequate, the deficit might be found by the commission through advanced rates—the only practical way in the estimation of the railroads' representatives—or by charging for so-called free allowances.

This latter question is to be taken up, however, regardless of what the decision may be on the first of the two main questions. Hence when Chairman Harlan last Friday at the close of the arguments said, "This ends this phase of the case," he did not bring out anything new, or indicate anything not already made plain in this case, although daily press reports would lead to the belief that an entirely new feature had been developed which pointed to prolonging the decision.

Attorney Patterson, of the Pennsylvania system, made the closing argument on behalf of the eastern railroads, replying to contentions of shippers who protested increased rates. President Willard, of the Baltimore & Ohio, followed Mr. Patterson, and was the last speaker. His was a short statement, in which he urged the necessity of the advance for the railroads, explained the publicity campaign carried on by the railroads to show it was entirely legitimate, and after thanking the commission and counsel on both sides for the patience and courtesies shown, said he was confident the commission would arrive at a just conclusion. In his closing remarks, Mr. Patterson begged the commission to grant the full relief demanded—the only relief, he said, which will "measurably affect the situation and conserve the sound economic development of the country." Mr. Patterson had been referring to the enormous outlay which the carriers have had to meet through increased wages, improvements, state and federal legislation and from other sources of expense. Agreeing with the arguments made during the morning by Attorney Brandeis for the commission that the railroads should conserve their efficiency, get greater passenger revenues, do away with so-called free allowances, etc., Mr. Patterson said that these matters would require prolonged litigation, with a questionable outcome, and that the carriers are urgently in need of more money at once.

Speaks for Many

He said he was speaking for the 202,000 stockholders interested in these railroads, with a capitalization of $7,000,000,000, and employing 750,000 men, upon whom 3,000,000 are dependent, annual wages being $570,000,000.

Railroad securities of today were said to be almost without exception short time notes issued on the basis of 5 and 6 per cent.

"We hope," said Mr. Brandeis, "the railroads won't be permanently financed on that basis."

Vigorously disagreeing with Mr. Brandeis, Mr. Patterson said that it did lie in the power of the commission to allow the suspended tariffs to go into effect generally, and that it did not have to go over them one by one—which would require years, it was contended—and enter an order according to the finding. Mr. Patterson said there are 22,000 of these tariffs involving perhaps 15,000,000 or 20,000,000 rates. It was declared that the carriers had started with the assumption that the rates were reasonable and non-discriminatory and that the relationship was equitable. The railroads proceeded, he said, on the assumption that the commission can make an increase on low grade commodities, such as coal, coke, ore, limestone, etc. Arguments made against increases on these commodities, made on behalf of the Pittsburgh Steel Co., and the Wheeling Steel & Iron Co. by Attorney Wade H. Ellis against increases on coke to eastern Pennsylvania furnaces by Attorney William A. Glasgow, and against coal rate increases by Attorney Frank Lyon, of the Pittsburgh Coal Co., were said by Mr. Patterson to be based entirely on the cost of service theory which had been answered repeatedly by the commission. He denied that increased trainloads and other economics had not injured to the advantage of these commodities, contending that millions of dollars had been spent by the carriers to create facilities for handling this traffic. The commission was urged not to lay down a ruling that sometime in the future the roads would find themselves better off. Interests of the country were declared to demand that the railroads get relief at once.

President Willard said the railroads are spending $200,000,000 annually for improvements and facilities, and that sum will be needed each year for some time to come for further improvements, while financial results have not justified such an expenditure. The publicity campaign of the railroads was said to have been decided upon following meetings of carriers' representatives with shippers throughout the affected territory, and was aimed to give to the press, legislators and public generally a dispassionate, fair and accurate statement of conditions. It was meant in no way, he urged, to compel hasty action by way of decision by the commission.

One point made by Attorney Ellis in opposing an increase on low grade commodities was that the railroads had reversed themselves with respect to the position they took in the 1910 case, when low grade commodities were not included in the proposed advances, it having been said by the railroads then that low grade commodities were already bearing more than their share of the cost of transportation. Mr. Ellis said the carriers had offered no defense for proposing an increase on low grade commodities. He urged that the proposal to increase rates on this traffic be separated from the rest of the case and made the subject for an investigation.

Mr. Ellis pointed out the line of demarcation between freight moving under the class rates and freight constituting raw materials, such as coal, coke, ore and limestone, which move

in carloads and often in trainloads. It cannot be assumed, it was urged, that because there may be a justification for an increase in class rates there follows of necessity an equal justification or any justification for an increase in the low grade commodity rates. Of the $1,000,000,000 gross operating freight revenue received in 1913, Mr. Ellis said, low grade commodities, constituting about 70 per cent of the total traffic, 1,200,000,000 tons, contributed about 70 per cent, or $700,000,000. The railroads, he said, estimate that the additional revenue they would receive under a general 5 per cent increase in revenue would be about $50,000,000 annually, a sum said to be substantially correct, assuming that all they are asking is an increase of 5 per cent. Still assuming that this percentage will be uniformly distributed over all commodities, it was said, the low grade commodities will have to contribute to this increase $35,000,000, or 70 per cent of the total increased revenue on a 5 per cent basis.

"But the exact proposal of the railroads," said Mr. Ellis, "is to increase the rates on low grade commodities a minimum amount of 5 cents per ton. At this rate the 840,000,000 tons of low grade commodities handled in 1913 would have earned $42,000,000, and this is the real increase in revenues for which the railroads are asking on these commodities alone! Upon the remaining 30 per cent of the tonnage and revenue the railroads are asking for an increase of 5 per cent, amounting to $15,000,000, thus making a total increase of nearly $60,000,000 annually." The increase asked for in 1910, it was said, would have amounted to $27,000,000, while the increase asked now from low grade commodities alone is $42,000,000.

Mr. Ellis said low grade commodities are being hauled at increasing cost per unit, but at a decreasing cost, due to greater train loads with cars and engines of more capacity and other improvements.

Protesting against the proposed increase of the 88 cents ore rate to 93 cents to Pittsburgh and Wheeling, W. Va., Mr. Ellis said the cost of transporting such a commodity from lower Lake Erie ports to Pittsburgh, a distance of 130 to 140 miles, being about the same as to Wheeling, does not exceed 30 cents. At a rate of 88 cents, therefore, he said, this commodity yields an "operating profit" of nearly 200 per cent. He said the ore rate from Cleveland to Ashtabula, O., to the Pittsburgh district at 60 cents per ton would yield nearly double the average car mile earnings on all traffic in the United States and nearly double that on such systems as the Lake Shore and Pennsylvania. The financial condition of lines whose chief traffic is made up of low grade commodities was pointed out in detail to show these carriers make enormous profits from such traffic. He indicated, as did Attorney Glasgow and Attorney Lyon, that if the commission returned a decision against their clients, the cases would be taken to the federal courts.

Great Improvement Plans

Being Carried Out by the Pennsylvania Steel Co.— Total Earnings Declined in 1913

Philadelphia, May 5.—Total earnings of the Pennsylvania Steel Co. for the year ended Dec. 31, 1913, amounted to $2,833,662, compared with $3,263,544, or a reduction of $429,882 over 1912. But an increase of $700,000 over the preceding year was charged to expenses of operation, for ordinary and extraordinary improvements. As has been previously reported, the company now is carrying forward extensive improvements and enlargements at its Steelton, Pa., works and also making some extensions at the Maryland Steel Co.'s plant at Sparrows Point. The company, during the past year, paid only one-half the dividends of the preceding year, or $514,020 less, which is in line with the policy to put a larger portion of earnings into improvements. The comparative income account of the company for the past two years, is as follows:

	1914.	1913.
Income from operation	$2,764,141*	$3,113,818
Other income	69,520	149,725
Total earnings	$2,833,662	$3,263,544
Bond interest	1,017,341	1,053,923
Net income	1,816,320	2,209,620
Depr. & sink. fund	1,186,676	1,159,532
Balance	$629,644	$1,050,088
Pref. dividend	514,020	1,028,040
	$115,624	$ 22,048
Misc. adjust	71,729†	1,138
Credit on R. R. stock	959,709	.....
	$983,604	$ 23,186
Prev. surplus	4,732,903	4,710,716
Surp. Dec. 31	5,736,507	4,733,902

*After operating expenses and allowance of $3,500,000 for ordinary and extraordinary repairs, compared with $2,800,000, similarly charged in 1912.

†Debit.

President Edgar C. Felton, in his remarks to the stockholders, says:

"The year 1913 opened with a large amount of business on the books of your subsidiary company. The active buying movement, which had existed in the latter part of 1912, continued during the first three months of 1913, after which the new business rapidly lessened in volume. The accumulation of orders from the previous year and for the first quarter of 1913 enabled the works of your subsidiary companies to operate at their capacity during the first half of the year. With the first of October, however, the accumulation of orders had disappeared and operations at all plants were radically curtailed, the steel-making plant of the Maryland Steel Co. being obliged to close early in December, because of the lack of orders for rails. The large production demanded of your Steelton Works during the first half of the year necessitated the operation of the older and more uneconomical open-hearth furnaces at that plant. This, in conjunction with high labor costs and high costs for supplies, prevalent during the most of the year, increased the costs of steel.

"The coke oven plant at Sparrows Point, one of the first of its type built in this country, which had been showing signs of giving out during the previous year, became radically worse in the spring of 1913 and had to be shut down finally during the last quarter of the year. The inefficiency of these coke ovens increased the cost of fuel used at Sparrows Point blast furnaces and resulted in high pig iron costs. The earnings for the first half of the year were sufficient to warrant a dividend of 2½ per cent on your preferred stock, which was paid on Nov. 1. The earnings for the second half of the year, due to the above causes and to the marked decline in business, were not sufficient to meet the dividend requirements for that period.

As to Ore Operations

"The iron ore mines of the Cornwall Ore Bank Co., located at Cornwall, Pa., in which you own a majority interest, produced 341,000 tons of iron ore in 1913, compared with 390,000 in 1912. Mining operations at this property were restricted during the year, due to the abnormally small consumption of ore by the companies other than your own which are interested in the property. Of the two iron mining properties in the island of Cuba owned by you, neither was operated to its capacity in 1913, because of the decreasing demand of your furnaces for iron ore. The older

property located at Daiquiri on the south coast of Cuba, produced 490,000 tons of iron ore in 1913, compared with 537,000 tons in 1912. The newer property located on the north coast of the island, near Nipe Bay, produced 676,000 tons of ore in 1913, compared with 821,000 tons in 1912. The sum of $184,470 was expended on these two properties during 1913 for improvements and betterments. Of this sum, $13,770 was capitalized, being the amount expended largely for the acquisition of new lands, to be used in connection with mining operations. The balance of this expenditure was charged currently to the costs of mining.

Has Great Program

"In May, 1913, a comprehensive program for the improvement of your steel plants was adopted, involving the expenditure of approximately $8,500,000. The part of this program affecting the Steelton works begun in 1913, provides for the abandonment of the older and more uneconomical open-hearth furnaces and the addition to the newer and more efficient open-hearth plant of one stationary and two tilting open-hearth furnaces and the construction of a Bessemer duplexing plant as an integral part of the open-hearth plant. This brings under one roof the entire steel-making capacity of the Steelton works and will, when completed, very considerably cheapen the cost of making steel. The carrying out of this plan involved the moving of blacksmith and other shops and office building to new locations. It also provided for extensive improvements to the merchant rolling mills, considerable additions to the forge department, the construction of a coal-washing plant in connection with the coke ovens and other minor improvements.

"The program of improvements to the Steelton works during the coming year covers the remodeling and consolidation of the present blooming, slabbing and rail mills, whereby the Steelton plant will be enabled to roll a larger variety of structural shapes and girder rails and with greater economy than heretofore. The plan also involves important improvements to the existing blast furnace plant. The plan for improvements to the Sparrow's Point plant, adopted in May, provided for the continuation of the rebuilding of the blast furnace plant then already under way, the building of an entirely new coke oven plant to take the place of that abandoned in the latter part of 1913, the addition of five gas blowing engines to the blast furnace department, together with important improvements to the Bessemer department and blooming mills. This plan had, at the end of 1913, been about half completed. The expenditures on account of these and other improvements to Dec. 31, 1913, were $1,557,620, of which $1,320,628 was charged to capital account and the balance to reserve account and to cost of manufacture. It is expected that the improvements undertaken during 1913 will be completed by the middle of 1914 and will result in considerable economies in the operating costs of the Sparrows Point plant."

Tariff Abuses

Will Not Be Tolerated in Canada Says Minister White

Toronto, May 4.—Further tariff readjustments are in prospect. On April 30, Hon. W. T. White, finance minister, intimated that when the government concluded to impose increased duties upon structural steel some further changes in the interest of bridge manufacturers might be necessary. Regarding the apprehension felt by the rail manufacturers that the duty on wire rods would injure the smaller manufacturers by placing them at the mercy of the large corporations, Mr. White said that if he were ever persuaded that advantage was taken of the tariff to suppress a cognate industry, he would not hesitate to recommend an order-in-council abolishing the duty. He cited the action of the government in cutting down the cement duty by one-half last year, as an earnest of his intention to see that the tariff was not abused for such a purpose.

The Dominion Steel Corporation is now operating its Sydney N. S. plant to 60 per cent of capacity, as compared with 40 per cent in January. President J. H. Plummer states that during April business has greatly improved owing to the opening of navigation and the active resumption of building operations.

The Workmen's Compensation Act passed by the Ontario Legislature has received the assent of the lieut.-governor, and is now law. It provides compensation to workmen by a state system administered by a commission having wide discretionary powers and supported by the provincial treasury, with a collective contribution from employers — no contribution being made by employes. In cases of permanent disability, the injured workman is entitled to weekly compensation, the maximum being fixed at 55 per cent of his average wages for the previous twelve months. In cases of death by industrial accident, the widow receives $20 per month and $5 per month for each child under 16, the maximum being $40. If the only dependents are children, the payment is $10 per month for each child under 16, the maximum to the family being $40. An annual appropriation of $100,000 is set aside by the government for the administration of the Act. The law does not apply to farmers or the clerical staffs of manufacturers.

May Lead to Consolidation

W. H. Donner, president of the Cambria Steel Co., has been tendered the chairmanship of the board of the Pennsylvania Steel Co. and the Maryland Steel Co., and an option has been taken by himself and associates upon the majority holdings of the Pennsylvania railroad in these companies. It has been reported for several months past that Mr. Donner and associates have been interested in acquiring these holdings which the railroad company has been desirous of disposing of for some time. If Mr. Donner accepts the chairmanship of the board of the Pennsylvania and Maryland companies, this act, it is understood, will not disturb his present connection with the Cambria Steel Co., but will result in a closer union and eventual consolidation of the three companies. At the present time, the Pennsylvania Steel Co. and the Maryland Steel Co. have no chairman of the board.

Properties Sold.—The various properties of the Temple Iron Co. were sold to the highest bidder at New York, May 1, in compliance with the decree of the courts in a government suit, ordering the dissolution of the company. The assets, consisting of stock in eight important coal mining companies, were sold to Thorne, Neale & Co., of New York City. This firm declined to state whom it represented.

The Massillon Electric & Gas Co., Massillon, O., which plans to triple its present size, will need new equipment as follows: One 1,500-kilowatt turbo-generator, another between 2,000 and 3,000 kilowatts in capacity, two 650-horsepower boilers, 200-foot stock, superheaters and condensers. Estimated cost is about $100,000.

The Pittsburgh office of Eaton, Rhodes & Co., Cincinnati, has moved from 1428 to 1642 Oliver building. The office is in charge of Joseph G. Walton.

TIPS FOR NEW BUSINESS

Equipment needs of the Iron and Steel works, Machine shops, Foundries and other Metal Working plants

In New York, the machinery market continues devoid of features of importance. With a few exceptions here and there, dealers generally report that current business is at a minimum. What business there is comes from manufacturing companies, as railroads still continue in their policy of rigid curtailment. The only railroad which now has purchases under consideration is the Southern Pacific, whose New York office has taken bids on a small list of machine tools. Demand for second-hand machinery is rather slack and demand from abroad continues to fall off.

In Pittsburgh, conditions in the market for machine tools and heavy rolling mill equipment remain unchanged. Scattering orders for single tools are being taken by dealers, and several attractive inquiries are pending, but there is absolutely no snap to buying. Builders of heavy mill equipment are filling orders taken earlier in the year.

In Chicago, the effect of the spring demand is being felt in some lines of machine tool making and improvement in conditions noted the past fortnight is continuing. No large lists are before the trade and business for the most part is for single tools or small installations.

In Cincinnati, the machine tool business was not as good in April as it was in March, and the outlook for May is not very bright. Some of the larger companies which have been getting the majority of orders are complaining that conditions are very slow, and some shops state that they have not received a good order for many months. The best sellers during April were lathes, milling machines, wood-working and metal-bending machinery. Local foundries are barely operating. Small electrical equipment showed a slight improvement in April over March. Second-hand machinery is quiet and unchanged.

EASTERN STATES

BANGOR, ME.—Penobscot Chemical Fibre Co. will receive bids at once for additions to its plant as follows: 110 x 120-foot main building, 30 x 100-foot acid plant, 40 x 50-foot digester building, 40 x 60-foot blow pit, all to be of brick, steel, and concrete. Clayton H. Delano is president.

ATHOL, MASS. — John A. McGregor of the Twist & Drill Co., announces that the firm will erect an additional cutter department.

BURRAGE, MASS.—The Sun Electric Co. has been incorporated; $25,000; by Gabriel B. Levy, Julius Nelson, Samuel O. Reinstein, Frank Sanford.

HOLYOKE, MASS.— The Cowan Truck Co., now occupying part of the building of the White & Wyckoff Co., has plans to obtain larger quarters or erect a plant in the near future.

MALDEN, MASS.—The proposed industrial building to be erected here is being arranged for by an organization with $100 000 capital; the first unit will be 200 feet long, of modern mill construction; estimated cost, $43,000.

SOMERVILLE, MASS.—Holton Abbott Mfg. Co. has been incorporated; machinery; $50,000; by E. C. Holton, Somerville, Mass., and A. F. Abbott, Medford, Mass.

SPRINGFIELD, MASS. — The George Smith Plumbing & Auto Metal Co. has been incorporated; $50,000; by George Smith, Jeremiah J. Moynihan, Michael H. Smith.

WORCESTER, MASS. — American Sales Machine Co. has been incorporated; $1,500,000; by Clarence W. Hobbs and Harry W. Goddard.

BRIDGEPORT, CONN. — Architects Skinner & Walker are drawing plans for the proposed plant of the American Chain Co.

BRIDGEPORT, CONN.—The Eastern Iron Co. has been incorporated; $5,000; by Barnett Ginsburg, Abraham Shapiro and Samuel Frank, all of this city.

STONINGTON, CONN.—The Atwood Machine Co. is building an addition to its plant.

ALBANY, N. Y.—The Modern Railway Appliance Co. has been incorporated to establish a general machine shop and foundry here for the manufacture of railway appliances; $20,000; by Walter V. Simmons, Charles A. Simmons, 245 North Pearl street, Albany, and John J. Canavan of Brooklyn, are directors.

AVON, N. Y.—The Enameled Steel Package Corporation has been incorporated; $700,000; by J. A. Cowles, J. H. Charity, H. R. Allen, Rochester.

BUFFALO, N. Y.—New York State Pneumatic Tool Co. has been incorporated; $200,000; by John G. Doster, William Bender, Henry Cutting, Buffalo.

BUFFALO, N. Y.—The Interstate Hydrostat Co., Inc., has been incorporated to manufacture and sell engines, boilers, electrical machinery and supplies for machine shops; $200,000; by Michael Anthony Eckel and Dr. G. A. Lenhard of Detroit and Charles F. Sherwood of Buffalo.

NEW YORK CITY.—R. T. Brooks & Co. has been incorporated; iron construction etc.; $10,000; by G. L. Kumpf, R. T. Brooks, G. Hortsmann, Mt. Vernon.

NIAGARA FALLS, N. Y.—Niagara Falls Searchlight Co., Inc., has been incorporated with $100,000 capital stock; incorporators, James F. Murphy, John Tugby and Firnum G. Anderson, all of Niagara Falls.

ROCHESTER, N. Y.—The General Railway Signal Co. has voted to increase its capital stock from $5,000,000 to $10,000,000.

ALLENTOWN, PA.—The Coplay Cement Mfg. Co. is rebuilding the machine shop wrecked by fire several months ago. It will also enlarge its engine house on account of installing electrical fixtures.

BUTLER, PA.—The Keystone Tank & Boiler Co. has leased a site on East Cunningham street on which it will erect a plant.

LEBANON, PA.—The American Iron & Steel Mfg. Co. will add to the electric equipment in its mill a 1500-horsepower induction mill type motor with sectional control equipment. The machine will be built and installed by the General Electric Company.

NORRISTOWN, PA. — The Freed Heater Co. is erecting an addition to its plant.

PHILADELPHIA. — Eynon Evans & Co. plan to build a foundry at Fifteenth and Clearfield streets.

PITTSBURGH.—The Riter - Conley Mfg. Co. has ordered 32 motors of 10-horsepower and 25-horsepower capacities from the General Electric Company.

SCRANTON, PA.—The Scranton Electric Co. will spend about $1,000,000 for improvements in Scranton and the valley during the coming year. Duncan Campbell, general manager.

SOUTH BETHLEHEM, PA.—The Bethlehem Steel Co. has ordered nine motors ranging from 10-horsepower to 50-horsepower; two additional 125-horsepower and two 150-horsepower induction motors from the General Electric Company.

NEWARK, N. J. — The Haussling Sash Mfg. Co. plans to erect a $20,000 brick factory, building permit secured.

DOVER, DEL.—The Excelsior Bending Co. of Pittsburgh has filed notice here of a capital stock increase of from $100,000 to $1,000,000.

DOVER, DEL.—The Wald Contracting Co. of Pittsburgh has filed articles of incorporation here with $50,000 capital; the company will do general contracting and construction of buildings, workshops, factories, mills,, etc. for manufacturing all kinds of goods, wares and merchandise; incorporators are Thomas Brown Jr., Fair Haven, Pa.; Joseph A. Lee, James J. Kane, both of Pittsburgh.

WILMINGTON, DEL.—The Salvador Motor Co. has ben incorporated; motor cars; $500,000; by S. J. Richards, Needham, Mass.; J. F. Brown, Newton, Mass.

WILMINGTON, DEL.—Johnson Electric Smelting Co., Inc., has been incorporated; electric furnaces, machinery, etc.; $4,500; by

H. R. Martindale, W. F. Cook, W. I. N. Lofland, Dover.

WILMINGTON, DEL.— The Maryland Electric Vehicle and Mfg. Co has been incorporated; vehicles of all kinds and electrical goods; $100,000; by J. M. Satterfield, W. P. Carrow, M. M. Hirons, Dover.

WILMINGTON, DEL.—Standard Auto Specialties Co. has been incorporated; Automobiles, cars, wagons etc.; $50,000; by L. H. Ryon, Philadelphia; W. C. Arnold, Lansdowne, Pa.; J. M. Satterfield, Dover, Del.

CENTRAL STATES

CINCINNATI. — A small amount of equipment will be needed by the Andrew Nessner Co., brass founder. The company is remodeling its plant on Patterson street.

CINCINNATI.—The R. K. LeBlond Machine Tool Co. will build an addition to its cutting department 20 x 90 feet, and two stories. Plans are being prepared by Zettle & Rapp, architects, of Cincinnati.

CINCINNATI.—The Stewart Iron Works Co. has reduced its capital stock from $1,000,000 to $5,000. No reason is given for this move. The company will continue in operation as formerly.

CINCINNATI.—The name of Peck-Williamson Heating & Ventilating Co. has been changed to the Williamson Heater Co. The change was made because the Pecks are no longer interested in the company, and the former name was confusing with the name of a similar concern in Cincinnati.

CINCINNATI.—About 900 tons of structural steel will be needed for the new building of the Western Methodist Book Concern, which will be erected on Fourth street, Cincinnati. The new structure will be six stories and will cost about $450,000. The architects in charge are Samuel Hannaford & Sons, Cincinnati.

CINCINNATI.—The general contract for the heating and lighting plant, and the sanitary sewage and sewage disposal plant for the heating and lighting plant, has been awarded to the Lord Construction Co., of New York City, by Walter G. Franz, consulting engineer, of Cincinnati, who has charge of this work. The contract calls for an expenditure of about $180,000.

CINCINNATI.—Plans have been posted by Bert Baldwin, consulting engineer, of Cincinnati, for another addition to the plant of the United States Can Co., Norwood, a suburb of Cincinnati. The new part will be 68 x 97 feet, and of brick and concrete construction re-enforced with steel. This company is at present constructing an addition 22 x 29 feet, to be used as a solder plant.

CINCINNATI.—A limited number of contractors have been asked by the Ford Motor Co. of Detroit, to give bids on the construction of an assembling plant at Lincoln avenue and the C. L. & N. Railroad, Cincinnati. All bids are to be in by May 10. The building will be 110 x 200 feet, five stories, terra cotta. The partition walls will be supported by steel posts, of which several hundred tons will be required.

CINCINNATI.—The M. A. Hunt Co. will build a new factory building on the site of its present plant at Dempsey street and the C. H. & D. railroad. The buildings will be of concrete and steel, and will be erected so as to use parts of the old portion while the new portions are under construction. The plans were prepared by the engineering department of this company, and call for an expenditure of about $50,000.

CINCINNATI.—A steel bridge which will cost between $160,000 and $200,000, and which will require about 600 tons of structural steel, will be built to span the Licking River, in Covington, a suburb of Cincinnati, by the South Covington & Cincinnati Street Railway Co. The new structure will take the place of the present one, which is not strong enough to carry the traffic to which it is subjected. The American Bridge Co. has been awarded the general contract.

CINCINNATI.—The Bullock Electric Mfg. Co., Norwood, O., a suburb of Cincinnati, has reduced its capital stock from $300,000,000 to $1,000,000. The business of this company will be carried on as formerly. The company's plant transferred to the Allis-Chalmers Mfg. Co., of Milwaukee, Wis., on May 1, the transaction involving no considerations. A mortgage for $936,000 was given on April 30 by the Bullock Electric Mfg. Co., to the First Trust Co., of Milwaukee, which covers the entire plant, but this was not transferred to the Allis-Chalmers Mfg. Co.

CLEVELAND.—The Ford Motor Co. plans to spend $600,000 for an assembling plant. The building site has been purchased.

CLEVELAND.—The Scott Bros. Co. plans to erect a 5-story, 60 x 124-foot brick, steel and concrete furniture sales and storage building; estimated cost, $45,000.

CLEVELAND. — A. Schiffer, 2235 East Eighty-fifth street, has secured a building permit for a two story addition to a brass foundry at 1366 East Forty-seventh street; estimated cost, $3,500.

COLUMBUS, O.—The name of the Uhrlandt Gas Generator Mfg. Co. has been changed to the Ohio Gas Generator Mfg. Co.

DAYTON, O.—Bridge building and repair bonds worth $15,000 were sold April 29 to the Dayton Savings & Trust Co. The money will be spent in Montgomery county.

DAYTON, O.—The county emergency commission is negotiating with the C. H. & D. railroad and the Ohio Electric railway concerning the proposed Miami bridge to be erected at Linden avenue; estimated cost, $240,000.

HAMILTON, O.—Bids will be taken soon for the construction of a new high school building. Frederick Mueller, Hamilton, and Frank S. Packard, Columbus, are the architects.

MANSFIELD, O. — The heating bids on the Newman and Third avenues schools were rejected at a meeting of the Board of Education on April 28, and new bids will be taken. Vernon Redding, of Mansfield, is the architect in charge.

MANSFIELD, O.—Architect Vernon Redding, Mansfield, O., will receive bids until May 20 for the erection of a high school building at Ashland, O. It will be of brick construction strongly supported with structural steel.

COVINGTON, KY.—The Stewart Iron Works has been incorporated; $1,000,000 capital stock; will establish iron works.

EVANSVILLE, IND.—The Evansville & New Harmony Traction Co., a firm with $15,000 capital stock, will build a 30-mile line from here to New Harmony. Local capitalists back the company.

NEWCASTLE, IND.—The equipment and stock of the Universal Tractor Co. was sold at receiver's sale on April 28, to A. A. Marshall of the Marshall-Huschart Machinery Co., Chicago, for $11,625. The property was appraised at $35,000. The plant will be reopened and operated.

CHICAGO.—The Illinois Central railroad will build a $400,000 hospital on Stony Island avenue north of the Midway. When completed, injured employees and passengers may be cared for there free of charge.

CHICAGO. — The O. Watrous-Acme Mfg. Co. has purchased a 1-1/2-acre site on Western avenue for the $300,000 hardware plant it plans to build. The building will have 135,000 square feet of floor area.

CHICAGO. — The Willys-Overland Co. of Toledo, O., has purchased a 100 x 300-foot lot here at Armour and Twenty-fourth streets and is reported as planning a building to cover the lot.

CHICAGO. — The Central Bureau of Consulting Engineers has been incorporated to undertake general engineering and contracting business; $25,000; by Chas. R. DeLeuw, May E. Ewing and Walter H. Allen, 823 East 89th street.

GENESEO, ILL.—Bids will be received until May 12 at the First National Bank for the Andrews Bridge including 130-foot steel span on reinforced concrete substructure; estimated cost, $6,700.

ROCK ISLAND, ILL.—M. & F. Electrical Co. has been incorporated to manufacture and deal in electrical apparatus, machinery, etc.; $2,500; by Martin McNealy, William McNealy and William Fox.

WINETKA, ILL.—H. K. Meyer is taking bids on a bank and office building, two stories and basement, 40 x 150 x 42 feet, to cost $30,000. Carnegie standard steel sections are specified.

GRAND RAPIDS, MICH.—Bids will be received until May 15 by Michigan Railway Engineering Co., care Fargo Engineering Co., Jackson, Mich., for a 5-span, double track arch bridge 500-feet long.

GRAND RAPIDS, MICH.—The Standard Building & Tool Co. has been organized with $25,000 capital stock by Nicholas H. Battjes, William J. Breen and Henry J. N. Battjes.

HASTINGS, MICH. — The Walters Bros. Elevator Co. has been incorporated with $10,000 capital stock.

BEAVER DAM, WIS.—The Western Malleables Co. has been incorporated; $400,000; by Louis N. Burn, A. C. Moeller, Emmett Horan Jr.

CHILTON, WIS.—The John Lauton Mfg. Co., gasoline engines and farm machinery, is building a 2-story, 75 x 120-foot addition for manufacturing and storage purposes. A little equipment is being purchased.

DEXTER, MO.—Mayor will take bids until May 18 for water works and sewer system; Frank L. Wilcox, engineer, Syndicate Trust building, St. Louis.

HOUSTON, MO. — The Houston Electric Light & Power Co. has been incorporated; $10,450; by M. C. Cayce, E. K. Lyles and C. E. Covert.

KANSAS CITY, MO.—The Radium Spring Co. has been incorporated; $250,000; by J. P. Nagel, H. H. Temple and W. H. Pond.

MARSHALL, MO.—The Missouri Gas & Electric Service Co. plans to spend about $10,000 on improvements and additional machinery.

ST. LOUIS. — The Murphy Machinery & Equipment Co. has made arrangements to rent the building of the Louisville & Nashville railroad at 1410 North Broadway. Certain changes in equipment are necessary. As soon as these can be made the new tenant will move in.

ST. LOUIS. — The St. Louis Hardware Mfg. Co., owned by Joseph H. Hacker, 2350 Benton street, has taken out building permit for a $1,200 addition to its factory.

ST. LOUIS. — The St. Louis Frog & Switch Co. plans to erect a $25,000 foundry building in Wellston adjoining its present plant.

ST. LOUIS. — Contracts will be let May 19 for furnishing and delivering materials at the City pipe yard as follows: No. 11,236, 1,000 tons of 3, 6, 20, 30 and 36-in. cast iron castings, $562.50 deposit required. No. 11,238, about 288 3, 6, 12 and 20-in. stop and tapping coated water pipe, $875 deposit required. No. 11,237, 270 tons of cast iron coated special valves, $329.88 deposit required. No. 11,239,

200 post fire plugs and 350 post fire plug top parts, $607.50 deposit required.

DAVENPORT, IA.—The Bettendorf Hydrogen Oxygen Co. plans to erect a $50,000 plant here.

MUSCATINE, IA.—The Muscatine Hotel Co., care of Barry Mfg. Co., 802 Mulberry 141 feet to cost $215,000.

HILLS, MINN.—Within the next three months, the village plans to erect a power house and purchase one 50-horsepower oil engine and a 37-1/2 kilo-volt-ampere, 3-phase, 2300-volt generator with switchboard, pole line and necessary auxilliaries.

SOUTHERN STATES

CHARLOTTE, N. C.—The Piedmont Electro-Chemical Co. has been incorporated to manufacture, sell and deal in alkalis and chemicals; $100,000; by I. Hechenbleiker, D. C. Charmichael and E. R. Bucher.

RALEIGH, N. C.—The Raleigh Cotton Oil Co. has secured four acres of the city farm site and work will start soon on a cottoon oil manufacturing plant.

ALBANY, GA.—Albany Power & Mfg. Co. plans to erect within the next three months, 10 miles of 6,600-volt, single phase, No. 4 copper wire transmission lines; purchase one 50-kilowatt 2300/6600-volt transformer, one 20-kilowatt and one 5-kilowatt 6600/150-volt transformer; also purchase during the next six months one 750-kilowatt 3-phase 60-cycle, 2300-volt turbo-generator complete with condensing equipment. E. S. Killebrew, superintendent.

COLUMBUS, GA.—Clifford J. Swift, vice president and general manager of the Swift Spinning Mills has announced a capital stock increase of from $180,000 to $300,000 to take care of improvements as follows: 3-story, 117 by 133-foot addition to the mill building, also additional machinery.

KEY WEST, FLA.—Lighthouse Inspector will receive bids until May 20, for furnishing metal work for North Bank light, Cedar Keys, Fla. Blank proposals and particulars may be obtained from the inspector at Key West.

OCALA, FLA.—City votes in June on $400,000 bonds for water works, etc.; C. W. Hunter, president of the council.

HARTSELLE, ALA.—J. R. White, who has just secured a 30-year franchise for an electric light plant announces that he will establish a modern and finely equipped plant; work to begin within the next 30 days.

DALLAS, TEX.—F. C. Pettibone of Galveston, president of the Union Terminal Co., will open bids in about 30 days for the proposed Dallas Union Depot to cost about $1,500,000.

EL PASO, TEX.—The El Paso Electric Railway Co. plans another addition to its system; estimated cost, $20,000.

CHATTANOOGA, TENN. — Tennesee Valley Water Co. has been incorporated; $100,000; by J. W. Adams, G. B. Adams, M. N. Whitaker, et al.

WESTERN STATES

BRUNING, NEB.—Bids will be received until 7 p. m., May 12, by C. G. Bruckert, clerk, for water works system to cost $11,778 and a light plant to cost $7,308. This includes 10,350 feet of 4 and 6-in. water main 5-feet deep, 10 hydrants, one 6-in., and seven 4-in. valves, one 10-in. well 80 feet deep, 40,000-gallon steel tank on 90-foot tower, deep motor-driven well pump, one 50-horsepower oil engine, 35-kilowatt direct current 110-120-volt three wire system generator, storage battery and pole line.

OMAHA, NEB. — The Nebraska Iron & Metal Co. has purchased a 3-story brick building from A. B. Alpirn for $11,000 and will occupy it after August 1.

WELLSVILLE, KAN.—Wellsville Light & Power Co. plans to build an electric power plant to include one 75-kilowatt, 3-phase, 60-cycle, 2300-volt belted generator with switchboard and necessary auxilliaries.

EKALAKA, MONT.—Ismay, Ekalaka & Southern railroad has been incorporated to construct a 44-mile electric railway from Ismay to this place and other points; $500,000 capital stock.

RED LODGE, MONT.—The Northwestern Improvement Co. plans to improve its machine and electric shops etc., at a cost of about $50,000.

BOISE, IDA.—The United States district court has authorized the receiver of the Idaho, Oregon Light & Power Co. to issue receiver's certificates to cover cost of completing Ox Bow Power plant at an approximate cost of $250,000.

SEATTLE, WASH. — Wilkeson Power, Light & Fuel Co. has been incorporated; $500,000; by F. L. Van Nice, J. L. Teig and Thomas M. Tennent.

WALLA WALLA, WASH. — The Walla Walla River Power Co. has been incorporated to construct an 1800-horsepower power plant on the Walla Walla river; capital stock, $120,000; work to start in a few months.

WALLA WALLA, WASH.—Gilbert Hunt and associates of this town have signed a contract with the town of Dundas, Canada, to build a threshing machine factory, feed grinder and general farm implement factory to be known as the Dominion Harvester Co. Ultimately the plant will employ about 500 men and represent an investment of about $750,000. Construction to start in two or three weeks.

EUGENE, ORE.—S. A. Buck & Sons of Monroe, Wash., have taken an option on the former site of the Standard Oil Co.'s tanks on High street. The company plans to erect a box and crate factory if cheap electricity can be obtained.

PORTLAND, ORE.—Contracts have been let for the 2-story addition to the plant of the Doernbecker Mfg. Co. at East Twenty-eighth street and Sullivan's Gulch to James P. Taylor who recently received the contract for a 6-story reinforced concrete building for the same company. The enlarged building will be 100 x 100 feet, of reinforced concrete to cost about $20,000; the new building which is to be 100 x 150 feet will cost $80,000.

SAN LUIS OBISPO, CALIF.—The Santa Maria Gas & Power Co. has been incorporated; $1,000,000; by T. B. Adams, P. O. Tietzen, J. F. Goodwin, J. E. Walker, et al.

SANTA BARBARA, CALIF. — The San Joaquin Light & Power Co. is organizing the Midlands counties Public Service Corporation as a subsidiary with $2,000,000 capital. The new firm will supply electric power and lighting facilities to the Santa Ynez Valley, the northern end of the county and all of San Luis Obispo county.

TORRANCE, CALIF. — The Union Tool Co. has secured the manufacturing rights of the Nurnburg-Diesel engines for the Pacific coast and will erect a 105 x 300-foot plant here.

TRADE NOTES

CANTON, O.—The David Wigert Boiler Works has moved here from Galesburg, increased its capital stock from $100,000 to $150,000 and changed its name to Wigert Boiler Works.

CHICAGO. — The Western Iron & Construction Co., Western avenue, has changed its name to the Federal Iron Works.

CHICAGO. — The Celfor Tool Co., 80 East Jackson Blvd., has increased its capital from $150,000 to $1,000,000, increased directors from five to seven and has increased the par value of its shares.

CHICAGO.—James B. Clow & Sons have increased their capital stock from $1,500,000 to $1,750,000. The company states the increase is simply to care for enlargement of business and no additions or changes in the plant are planned.

CHICAGO. — The Chicago District Sales office of the Lackawanna Steel Co. announces its removal to 2073 Continental and Commercial Bank building, 208 South La Salle street. All orders for material, inquiries for prices, and correspondence relative to the same, should now be addressed to Arthur P. Van Schaik, district sales manager at the above address.

CHICAGO.—J. V. Cowling & Co. have moved from 72 West Adams street, to new offices at 973 Continental and Commercial National Bank building, LaSalle and Adams streets. This concern is direct western mill representative of the Cleveland Steel Co., Eureka Brass Co., Garland Nut & Rivet Co., Trumbull Co., Zugg Iron & Steel Co., and the Heppenstall Forge & Knife Co.

CINCINNATI.—The offices of the Allyn Co., architect, which are now in the Second National Bank building, Cincinnati, will be moved to the twenty-third floor of the Union Central building on May 1.

CINCINNATI.—H. H. Klusman, of the Greaves-Klusman Tool Co. has sold his interests in this concern to C. H. M. Adkins and S. H. Reck, of Cincinnati. The company will be reorganized and capitalized at $150,000. The products will be engine lathes and wood working machinery. Mr. Reck will be secretary of the new concern.

CINCINNATI. — The American Oxygen Co. has begun the operation of its plant at Oakley, a suburb. The company has leased a warehouse at 231 West Second street, to use as a storage place for local trade, but will supply outside territory direct from the factory. The product will be oxygen tanks and apparatus for the various uses to which this gas can be put.

CLEVELAND. — Arthur G. McKee, of Cleveland, engineer and general contractor for power plants, coal storage and handling plants, Baker suspension storage bins, etc., has opened a branch office in New York City at 52 Broadway, in charge of P. M. Stewart.

DAYTON.—The Central Dayton Building Co. will erect a 13-story office building in that city in the near future. The general contract for the construction has been let to the Ferro Concrete Construction Co., Cincinnati. Considerable electrical and heating equipment will be required.

ERIE, PA.—The Erie Scrap Iron Co. has been incorporated at Erie, Pa., to succeed the Erie Tube Welding & Junk Co., with a capital of $15,000. H. F. Mentzer is president and treasurer; E. Emerson, vice president, and G. R. Moran, secretary. The concern will deal in waste materials and second-hand machinery.

HUNTINGTON, W. VA.—The Jarvis Machinery & Supply Co. recently filed a voluntary petition in bankruptcy. Liabilities amount to $53,408.39 and assets $80,408.39.

NATICK, MASS.—The Natick Steel Equipment Co. has leased and will occupy immediately a large portion of the Pratt Shoe Co.'s plant.

SOUTH BEND, IND.—The South Bend Malleable Iron Co. has filed notice of its dissolution.

St. JOSEPH, MO.—St. Joseph Structural Steel Co., organized to fabricate structural steel for mill buildings, has purchased a plant already in operation; T. W. Dodd, general manager.

ST. LOUIS. — Elliot Bros., makers of switches, have bought the old Steel Wheel & Wagon factory at Pueblo, Col., and will fit it for their own use; $50,000 worth of machinery is already ordered.

IRON AND STEEL PRICES

Corrected up to Tuesday noon

PIG IRON

(First half delivery.)

Bessemer, valley	$14.00
Bessemer, Pittsburgh	14.90
Basic, Pittsburgh	13.90
Basic, eastern Pa.	14.00
Malleable, Pittsburgh	14.15 to 14.40
Malleable, Chicago	14.25
Malleable, Philadelphia	15.50 to 15.75
Malleable Buffalo	13.50 to 14.00
No. 1X Philadelphia	15.25 to 15.50
No. 2 foundry, Pittsburgh	14.15 to 14.40
No. 2 foundry, Cleveland	14.25
No. 2 foundry, Ironton	13.50
No. 2 foundry, Chicago	14.25
No. 2X foundry, Philadelphia	14.75 to 15.25
No. 2X foundry, New York	14.75 to 15.25
No. 2X foundry, Buffalo	13.50 to 14.00
No. 2 plain, Philadelphia	14.50 to 14.75
No. 2 plain, New York	14.50 to 14.75
No. 2 plain, Buffalo	13.75
No. 2 southern, Birmingham	10.50 to 11.00
No. 2 southern, Cincinnati	13.75 to 14.25
No. 2 southern, Chicago	14.85 to 15.85
No. 2 southern, Philadelphia	14.75 to 15.00
No. 2 southern, Cleveland	14.85 to 15.35
No. 2 southern, New York	14.75 to 15.25
No. 2 southern, St. Louis	14.50 to 15.00
Virginia, 2X, Philadelphia	15.30 to 15.55
Virginia, 2X, Jersey City	15.60 to 15.85
Virginia 2X, New Eng., all rail	16.20 to 16.70
Gray forge (eastern Pa.)	13.90 to 14.25
Gray forge, Pittsburgh	13.65 to 13.90
Gray forge, Birmingham	9.50 to 10.00
Silveries, 5 per cent, Cleveland	17.30 to 17.55
Silveries, 5 per cent, Birmingham	12.50
Silveries, 5 per cent, Chicago	16.85
Silveries, 8 per cent furnace	15.75 to 16.00
Standard low phos., Phila.	21.00
Lebanon low phos., furnace	17.00 to 17.50
Low phos., Pittsburgh	21.65 to 21.90
Charcoal, Lake Superior, Chgo., Nos. 1 to 4	15.75 to 16.50
Charcoal, Buffalo	16.00 to 17.00
Charcoal, Birmingham	25.00
Middlesbrough, No. 3, Phila., ex ship	15.00 to 15.25

IRON ORE

(Lower lake ports.)

Old range Bessemer, 55 per cent	$3.75
Mesabi Bessemer, 55 per cent	3.50
Old range, non-Bes., 51½ per cent	3.00
Mesabi, non-Bessemer, 51½ per cent.	2.85

(Per unit Philadelphia.)

Foreign Bess., 50 to 65 per cent	7 to 8c
Foreign non-Bess., 50 to 65 per cent.	7 to 8c

COKE

(At the ovens.)

Connellsville furnace	$1.85 to 1.90
Connellsville fur. contr.	2.00
Connellsville foundry	2.40 to 2.65
Connellsville fdy., contr.	2.50 to 2.75
Wise county furnace	1.90 to 2 10
Wise county foundry	2.40 to 3.10
Pocahontas furnace	1.90 to 2.40
Pocahontas foundry	2.40 to 2.75
New River, foundry	2.70 to 3.25
New River, furnace	2.40 to 2.75

FERRO-ALLOYS

Ferro-manganese, Baltimore	$38.00 to 39.00
Ferro-silicon, 50 per cent, Pbgh.	71.00 to 73.00
Ferro-silicon, 50 per cent, Phila.	71.00 to 73.00
Ferro-sil., 12 to 13 per cent, Pgh.	22.90
Ferro-sil., 11 to 12 per cent, Pgh.	21.90
Ferro-sil., 10 to 11 per cent, Pgh.	20.90
Ferro-sil., 9 to 10 per cent, Pgh.	19.90
Ferro-carbon titanium, carloads, per lb.	8c to 12½c

SEMI-FINISHED STEEL

Bes. billets, Pbgh. and Yn.	$20.00
Open-hearth bl., Pbgh. and Yn.	20.00
Open-hearth bil., Phila.	22.40 to 23.40
Bes. sheet bars, Pbgh. and Yn.	21.00
Op.-h'th sh. bars, Pbgh. & Yn.	21.00
Forging billets, Phila.	26.40 to 27.40
Forging billets, Pittsburgh	25.00
Wire rods, Pittsburgh	26.00

RAILS AND TRACK MATERIAL

Stand. Bess., rails, Pbgh.	1.25c
Stand. open-hearth rails, Pbgh.	1.34c
Light rails, 8 lbs., Pbgh. or Chi.	1.40c
Lgt. rails, 12 lbs., Pbgh. or Chgo.	1.35c
Lgt. rails, 16 to 20 lb., Pbgh. or Chicago	1.30c
Lgt. rails, 25 to 45 lbs., Pbgh. or Chicago	1.25c
Relaying rails, standard, Chgo.	23.00 to 24.00
Relaying rails, light, Chicago	$21.50 to 22.50
Angle bars, st. sect. Pbgh., base	1.50c
Angle bars, st., sections, Chgo.	1.50c
Spikes, railroad, Pbgh.	1.40c to 1.45c
Spikes, railroad, Chgo.	1.55c
Track bolts, Pbgh.	2.00c
Track bolts, Chgo.	2.00c

SHAPES, PLATES AND BARS

Structural shapes, Pittsburgh	1.15c to 1.20c
Structural shapes, Chicago	1.30c to 1.35c
Structural shapes, Philadelphia	1.25c to 1.30c
Structural shapes, New York	1.26c to 1.31c
Structural shapes, San Francisco	2.00c to 2.05c
Tank plates, Chicago	1.30c to 1.35c
Tank plates, Pittsburgh	1.15c
Tank plates, Philadelphia	1.30c to 1.35c
Tank plates, New York	1.31c to 1.36c
Bars, soft steel, Pittsburgh	1.15c to 1.20c
Bars, soft steel, Chicago	1.30c to 1.35c
Bars, soft steel, Philadelphia	1.30c to 1.35c
Bars, soft steel, New York	1.31c to 1.36c
Hoops, carloads, Pittsburgh	1.25c to 1.30c

Freight Rates, Finished Material

From Pittsburgh, carloads, per 100 pounds, to:—

New York	16 cents
Philadelphia	15 cents
Boston	18 cents
Buffalo	11 cents
Baltimore	14½ cents
Cleveland	10 cents
Cincinnati	15 cents
Chicago	18 cents
Minneapolis and St. Paul	32 cents
Denver	67½ cents
St. Louis	22½ cents
New Orleans	30 cents
Birmingham	45 cents
Pacific coast, plates and shapes	80 cents

Hoops, less carloads, Pittsburgh.	1.35c
Bands, Pittsburgh	1.15c to 1.20c
Shafting, carloads, Pbgh., disc.	65
Shaft'g less carl'ds, Pbgh., disc.	62
Bar iron, Chicago	1.10c to 1.12½c
Bar iron, Philadelphia	1.20c to 1.25c
Bar iron, New York	1.25c to 1.30c
Bar iron, Cleveland	1.20c to 1.25c
Bar iron, Pittsburgh	1.30c
Hard steel bars, Chicago	1.25c to 1.30c
Smooth finish'g mchy. steel, Chi.	1.68c

SHEETS AND TIN PLATE

No. 28, black, Pittsburgh	1.90c to 2.00c
No. 28 black, Chicago	2.03c to 2.08c
No. 28, tin mill, black, Pbgh.	1.85c to 1.90c
No. 28, galvanized, Pbgh.	2.80c to 2.90c
No. 28, galvanized, Chgo.	3.03c to 3.08c
No. 28, cor. galv., Pbgh.	3.00c to 3.10c
No. 28, painted cor., Pbgh.	2.10c to 2.20c
No. 10, blue annealed, Pbgh.	1.40c
No. 10, blue annealed, Phila.	1.55c to 1.60c
Tin plate, 100 lb., coke, base	$3.40

IRON AND STEEL PIPE

(Pittsburgh.)

	Black Butt-weld.	Galv. Butt-weld.
Steel, ¾ to 3 inches	80	71½
Iron, ¾ to 2½ inches	70	61
	Lap-weld.	
Steel, 2½ to 6 inches	79	70½

BOILER TUBES

Steel, 3½ to 4½ inches	72
Iron, 3½ to 4½ inches	60

WIRE PRODUCTS

Wire nails, jobbers, Pittsburgh	$1.60
Wire nails, retailers, Pittsburgh	1.65
Plain wire, jobbers, Pittsburgh	1.40
Plain wire, retailers, Pittsburgh	1.45
Galvanized wire, jobbers, Pbgh.	1.80
Galvanized wire, retailers, Pbgh.	1.85
Polished staples, Pbgh.	1.60
Galvanized staples, Pbgh.	2.00
Barb wire, painted, jobbers, Pbgh.	1.60
Barb wire, painted, retailers, Pbgh.	1.65
Barb wire, galv., retailers, Pbgh.	2.05
Barb wire, galv., jobbers, Pbgh.	2.00

BOLTS AND NUTS

(Delivered within 20-cent freight radius.)

Carriage bolts, ⅜ x 6 inches, smaller and shorter, rolled threads, 80 and 2½; cut threads, 75 and 17½; larger and longer, 70 and 15.

Machine bolts and hot pressed nuts ⅜ x 4 inches, smaller and shorter, rolled, 80 and 7½; cut, 80 and 2½; larger and longer, 70, 10 and 10.

Gimlet and cone point lag or coach screws, 80 and 20.

Hot pressed square, blank and tapped nuts, $6.00 off list; hot pressed hexagon blank or tapped, $6.70.

Cold pressed, C. & T. square, blank, or tapped, $3.80 off; hexagon, blank or tapped, ⅜ inch and larger, $6.80; ⅓-inch and smaller, $7.40.

RIVETS

Structural rivets, Pbgh.	1.60c to 1.65c
Structural rivets, Chgo.	1.73c to 1.78c
Boiler rivets, Pbgh.	1.70c to 1.75c
Boiler rivets, Chgo.	1.83c to 1.88c

SCREWS

(New York.)

Lag, gimlet and cone point	80 and 20
Coach, gimlet point	80
Standard jack	70 and 10
Mch., cut thread, flat head	50 and 10
Mach., cut thread, round head	50 and 10 and 10
Mch., cut thread, fillister hd.	40 and 40 and 10
Mch., rolled thread, flat head or round head	80 and 10
Set screws, iron	75 and 10 and 10
Set screws, steel, per cent advance over iron	25
Square head cap screws	70 and 10 and 10
Hexagon head cap screws	70 and 10 and 10
Fillister head cap screws	60 and 10 and 10
Flat head wood screws	10 and 10 and 5
Round head wood screws	10 and 10 and 5

WASHERS

(Discounts, Iron or Steel, to Jobbers, Cleveland.)

⅛-inch	$7.25
⅛-inch	7.00
¼-inch	7.00
⅝-inch	7.00
¾-inch	7.00

STEEL SHEET PILING

(Pittsburgh.)

Base sizes	1.55c to 1.60c

TWISTED REINFORCING BARS

(Soft steel, Pittsburgh mill.)

¼-inch and larger	1.25c
⅝-inch	1.30c
½-inch	1.35c
⅝-inch	1.50c
¾-inch	1.75c

IRON AND STEEL PRICES

Corrected up to Tuesday noon

TACKS

(New York.)

	Discount.
American carpet tacks	90 and 20 and 10
American cut tacks	90 and 20 and 10
Railroad tacks	90 and 40
Gimp tacks	90 and 20 and 10
Finishing nails	70

WIRE ROPE

Galvanized, iron and steel	47½ and 2½
Bright, iron and steel	55 and 2½

TRIANGLE REINFORCING MESH

(Per 100 square feet f. o. b. mill, car loads.)

No. 4, plain	$1.00
No. 4, galvanized	1.12
No. 7, plain	.49
No. 7, galvanized	.55
No. 23, plain	1.69
No. 23, galvanized	1.88
No. 26, plain	1.17
No. 26, galvanized	1.30
No. 27, plain	.96
No. 27, galvanized	1.07
No. 31, plain	2.49
No. 31, galvanized	2.76
No. 35, plain	1.17c
No. 35, galvanized	1.30
No. 39, plain	3.05
No. 39, galvanized	3.38
No. 43, plain	1.10
No. 43, galvanized	1.23

SPIRAL RIVETED PIPE

(Per 100 linear feet, f. o. b. factory.)

4-inch, plain	$ 19.76
4-inch, galvanized	30.74
6-inch, plain	33.05
6-inch, galvanized	49.73
8-inch, plain	43.17
8-inch, galvanized	65.00
10-inch, plain	66.42
10-inch, galvanized	96.15
12-inch, plain	83.75
12-inch, galvanized	118.30
14-inch, plain	99.14
14-inch, galvanized	138.85
16-inch, plain	117.53
16-inch, galvanized	166.58
20-inch, plain	183.79
20-inch, galvanized	248.39
24-inch, plain	219.92
24-inch, galvanized	293.99
30-inch, plain	324.81
30-inch, galvanized	430.64

CAST IRON PIPE

Three to 24 in., Cleveland	$22.35 to 22.80
Four-inch, water, Chicago	26.50
Six to 12 inches, Chicago	24.50
Larger sizes, Chicago	24.00
Six inch, water, New York	21.00 to 22.00
Four-inch, water, Birmingham	21.50
Six inch and larger, Birmingham	19.50
Gas pipe, $1 per ton higher than water.	

WAREHOUSE PRICES

Steel bars, Chicago	1.65c
Steel bars, Cleveland	1.80c
Steel bars, Cincinnati	1.70c to 1.85c
Steel bars, Philadelphia	1.65c to 1.70c
Steel bars, New York	1.80c
Iron bars, Chicago	1.65c
Iron bars, Cleveland	1.75c
Iron bars, Cincinnati	1.65c to 1.75c
Iron bars, Philadelphia	1.60c to 1.65c
Iron bars, New York	1.65c to 1.70c
Hoops, Chicago	2.15c
Shapes and plates, Chicago	1.75c
Shapes and plates, Cleveland	1.90c
Shapes and plates, Cincinnati	1.80c to 1.90c
Shapes and plates, Philadelphia	1.65c to 1.70c
Shapes and plates, New York	1.85c
No. 10 blue ann. sheets, Chgo.	1.95c
No. 10 blue ann. sheets, Cleve.	2.15c
No. 10 blue ann. sheets, Cinci.	1.95c to 2.05c
No. 28 black sheets, Chgo	2.55c
No. 28 black sheets, Cleveland	2.60c
No. 28 black sheets, Cincinnati	2.45c to 2.55c
No. 28 galv. sheets, Chgo	3.60c
No. 28 galv. sheets, Cleveland	3.60c
No. 28 galv. sheets, Cincinnati	3.45c to 3.55c

IRON AND STEEL SCRAP

(Net tons.)

No. 1 railroad wrought, Chgo.	$ 8.50 to 9.00
No. 1 railroad wrought, Cleve.	9.50 to 10.00
No. 1 R. R. wght., eastern Pa.	14.00 to 14.50
No. 1 railroad wrought, St. L.	7.75 to 8.00
No. 1 railroad wrought, Cinci.	8.50 to 9.00
No. 2 railroad wrought, Chgo.	8.25 to 8.50
No. 2 railroad wrought, St. L.	7.50 to 7.75
Arch bars and transoms, Chgo.	12.00 to 12.50
Arch bars and transoms, St. L.	11.00 to 11.50
Knuckles, coup. and spr'gs, Chgo.	9.00 to 9.50
Knuckles, coup., and sp'gs, St. L.	9.00 to 9.25
Shafting, Chicago	11.50 to 12.00
Shafting, St. Louis	13.00 to 13.50
Steel car axles, Chgo	12.25 to 12.75
Steel car axles, St. Louis	11.50 to 11.75
Locomotive tires, Chicago	10.00 to 10.50
Locomotive tires, St, Louis	9.00 to 9.50
Cut forge, Chicago	8.75 to 9.00
Pipes and flues, Chicago	7.00 to 7.25
Pipes and flues, Cleveland	8.00 to 8.50
Pipes and flues, St. Louis	6.50 to 7.00
No. 1 cast, Chicago	9.75 to 10.25
No. 1 cast, Cleveland	10.75 to 11.00

Freight Rates, Coke

Connellsville regions, per 2,000 lbs., to:—	
Baltimore	$1.80
Buffalo	1.85
Chicago	2.50
Cleveland	1.60
Detroit	2.10
East St. Louis	2.80
Joliet	2.50
Louisville	2.50
Milwaukee	2.70
New York	2.85
Philadelphia	2.05
Pittsburgh	.75
Richmond, Va.	2.94
Toledo	1.85
Valley furnaces	1.20
Cincinnati	2.00

No. 1 cast, Cincinnati	10.00 to 10.50
No. 1 cast, St. Louis	10.00 to 10.50
No. 1 busheling, Chicago	7.50 to 8.00
No. 1 busheling, Cleveland	8.50 to 9.00
No. 1 busheling, Cincinnati	6.25 to 6.75
No. 1 busheling, St. Louis	7.50 to 8.00
No. 2 busheling, Chicago	6.00 to 6.50
No. 1 boiler plate, cut, Chgo.	6.50 to 7.00
No. 1 boiler plate, cut, Buffalo	9.00 to 9.50
No. 1 boiler plate, cut, St. L.	6.00 to 6.50
Boiler punchings, Chicago	9.75 to 10.25
Cast borings, Chicago	4.50 to 5.00
Cast borings, Cleveland	6.00 to 6.50
Cast borings, Cincinnati	4.25 to 4.75
Cast borings, St. Louis	4.00 to 4.50
Machine shop turnings, Chgo.	5.25 to 5.75
Machine shop turnings, Cleve.	5.50 to 6.00
Machine shop turnings, Cinci.	4.50 to 5.00
Machine shop turnings, St. L.	4.50 to 5.00
Malleable, agricultural, Chgo.	8.50 to 9.00
Malleable, agricultural, St. Louis	7.25 to 7.50
Malleable, railroad, Chicago	9.75 to 10.25
Malleable, railroad, Cincinnati	6.50 to 7.00
Malleable, railroad, St. Louis	8.00 to 8.25
Angle bars, iron, Chgo	11.75 to 12.25
Angle bars, iron, St. Louis	10.00 to 10.50
Angle bars, steel, Chgo	8.25 to 8.75
Angle bars, steel, St. Louis	9.00 to 9.50
Stove plate, Chicago	9.25 to 9.75
Stove plate, Cleveland	8.25 to 8.75
Stove plate, Buffalo	9.75 to 10.00
Stove plate, Cincinnati	7.00 to 7.50
Stove plate, St. Louis	7.50 to 8.00
Bundled sheet, Cincinnati	4.75 to 5.25
Wrought iron pil'g plates, Clev.	13.00

(Gross Tons.)

Heavy melting steel, Pbgh	$12.09
Heavy melting steel, Buffalo	10.00 to 10.50
Heavy melting steel, Chicago	10.00 to 10.50
Heavy melting steel, Cleveland	10.00 to 10.75
Heavy melting steel, Cincinnati	9.00 to 9.50
H'vy melting steel, eastern Pa.	10.75 to 11.00
Heavy melting steel, New York	8.50 to 8.75
Heavy melting steel, St. Louis	11.00 to 11.50
Bundled sheet, Buffalo	6.25 to 6.50
Grate bars, Buffalo	9.50 to 10.00
Grate bars, New York	6.00 to 6.50
No. 1 railroad wr'ght, east. Pa.	13.00 to 13.50
No. 1 railroad wrought, Pbgh.	11.00 to 11.50
No. 1 R. R. wght., New York	11.00 to 11.50
No. 1 R. R. wrought, Buffalo	11.00 to 11.50
Shafting, New York	12.25 to 12.50
Pipes and flues, New York	8.00 to 8.25
Pipes and flues, eastern Pa.	10.00 to 10.50
Mch. shop turnings, New York	5.50 to 5.75
Machine shop turnings, Buffalo	5.50 to 6.00
Mch. shop turnings, Pbgh	8.00
Mch. shop turnings, eastern Pa.	7.50 to 8.00
Cast borings, New York	5.50 to 5.75
Cast borings, eastern Pa	8.00 to 8.50
Cast borings, Buffalo	6.00 to 6.50
Cast borings, Pittsburgh	8.25 to 8.50
Stove plate, New York	7.50 to 7.75
Stove plate, Pittsburgh	9.50 to 9.75
Stove plate, eastern Pa	8.50 to 9.00
Shoveling steel, Chicago	9.25 to 9.50
Shoveling steel, St. Louis	9.00 to 9.50
Reroll'g rails, 5 ft. & ov., Pbgh.	13.00 to 13.25
Reroll. rails, 5 ft. and ov., Chgo.	11.25 to 11.75
Reroll. rails, 5 ft. and ov., Cleve.	11.75 to 12.25
Rerolling rails, 5 ft. and over, eastern Pa.	12.25 to 12.75
Reroll. rails, 5 ft. and ov., St. L.	12.00 to 12.50
Steel rails, short, Chicago	10.75 to 11.25
Steel rails, short, Cleveland	13.00 to 13.50
Steel rails, short, eastern Pa.	11.00 to 11.25
Steel rails, short, St. Louis	11.50 to 12.00
Iron rails, Cleveland	13.50 to 14.00
Iron rails, Cincinnati	10.50 to 11.00
Iron rails, eastern Pa	15.00 to 16.00
Iron rails, St. Louis	12.00 to 12.25
Frogs, switches, guards, Chgo.	9.75 to 10.25
Frogs, switches and g'rds, St. L.	10.25 to 10.50
Car wheels, (iron), Pittsburgh	12.00 to 12.50
Car wheels (steel) Pittsburgh	13.00 to 13.50
Car wheels, Chicago	11.50 to 12.00
Car wheels, eastern Pa	12.00 to 12.50
Car wheels, Buffalo	12.00 to 12.50
Car wheels, N. J. points	11.50 to 12.00
Car wheels, St. Louis	11.00 to 11.25
Iron axles, Pittsburgh	22.50 to 23.00
Iron axles, Cincinnati	19.00 to 20.00
Iron axles, eastern Pa	20.00 to 21.00
Iron axles, Buffalo	21.50 to 22.00
Iron axles, Chicago	17.00 to 17.50
Steel car axles, New York	13.00 to 13.25
Steel car axles, Buffalo	15.00 to 15.50
Steel car axles, Cleveland	16.50 to 17.00
Steel car axles, eastern Pa	14.00 to 14.50
No. 1 busheling, Buffalo	8.50 to 9.00
No. 1 busheling, Pittsburgh	10.00 to 10.25
No. 2 busheling, Buffalo	6.00 to 6.50
Low phosphorus steel, Buffalo	15.00 to 15.50
Low phosphorus steel, Pbgh	14.00 to 14.25
Low phos. steel, eastern Pa	14.50 to 15.00
No. 1 forge, eastern Pa	8.50 to 9.00
No. 1 cast eastern Pa	13.00 to 13.50
No. 1 cast, Pittsburgh	12.00 to 12.25
No. 1 heavy cast (N. J. points)	12.00 to 12.50
Boiler plate, Cleveland	7.50 to 8.00
Mall. iron, agricul., Cleveland	9.00 to 9.50
Mall. iron R. R., Cleveland	10.50 to 11.00
Malleable, railroad, Pittsburgh	10.00 to 10.25
Malleable R. R. Buffalo	10.75 to 11.25
Mal., R. R. east. Pa.	9.00 to 9.50
Bundled sheet, Pittsburgh	8.50 to 8.75
Bundled sheet, Cleveland	6.50 to 7.00

MISCELLANEOUS SHOP TOOLS

	Discount.
Standard files	80 and 5
Heavy hammers, 3 to 5 lb	80 and 10
Heavy hammers, over 5 lb	80 and 5
Gas pliers, 7-inch, per dozen	$2.00
Gas pliers, 12-inch, per dozen	3.50
Cold chisels, per pound	12c to 15c
Wrenches, Alligator, discount	75 and 80
Wrenches, drop forged S.	50 and 10

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For boring automobile cylinders. We build **Single Spindle, Two Spindle** and **Four Spindle** machines.

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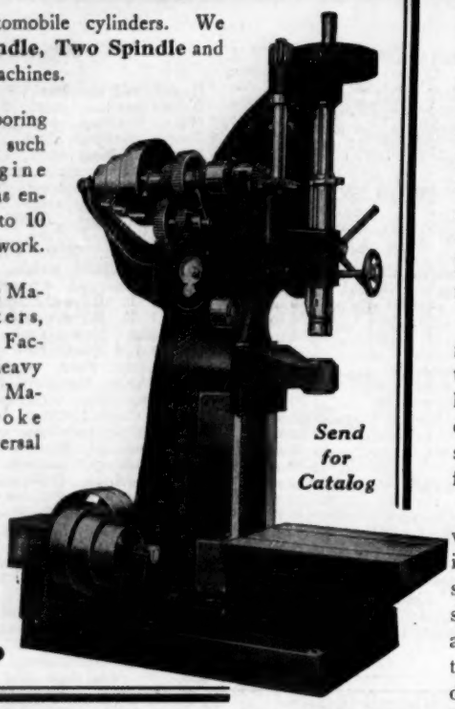

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Improvements in Case Hardening

(*Continued from page* 843)

hard bar will not hold the file up until the angle falls to about 15 degrees to 20 degrees. A hardened and tempered bar gives readings between these angles according to the degree of temper. Another form adapted to take larger articles is made with three triangular files, so that the outer two can be moved further apart at will, as shown in Fig. 6. For concave surfaces such as the ball races of motor car bearings a different type, Fig. 5, is employed. The essential part of this is a short piece of round file which, with its two ends resting on the bearings, slides down one side, or is deflected as the bearing is rotated. The angle taken up depends on the hardness and consequent friction, and is measured on a graduated quadrant. For flat surfaces a short file is mounted in a holder which slides along a smooth bar until friction arrests the motion.

Both the quadrant sclerometer and Shore scleroscope give low readings for small diameters. With the former the difference is greater for soft, and with the latter for hard bars. This is probably due to the file teeth in the one case, and the falling weight in the other, throwing up steeper "ramparts" round the depression when the surface is less convex.

For commercial testing of hardened work and within wide limits the error due to varying diameter is negligible in the case of the quadrant sclerometer. That the instrument is very sensitive is shown by the way it detects slight degrees of tempering. Several are in regular use at both the Rudge and Whitworth works, where they have to a large extent superseded the cruder hand test with ordinary files. They are handy and quick, and capable of dealing with large quantities of work in a short time. Instead of files, carborundum or alundum sticks or pencils may be employed, but files give very good results and last many months without showing any errors due to wear, provided they are properly made and appropriately aged before use. Various standards have been adopted for different articles, and the angle should come between the specified limits in order to pass the viewer.

Many articles, such as cups and cones, cannot be conveniently tested with a scleroscope or sclerometer on account of their shape. Realizing the need for some method which would enable articles of all sorts to be tested in bulk, the author turned his attention to the production of colors on hardened surfaces which would afford an indication of the nature of the steel composing such surfaces. The ordinary solutions employed by the metallographer are unsuitable for commercial application, some because of their inflammability, others because they will not flow evenly over a somewhat oily or greasy surface. A suitable solution which has been found to give satisfactory results consists of alcohol, 1 litre; distilled water, 1 litre; and nitric acid, pure, 100 cubic centimetres. Articles ground or polished after hardening and immersed in this for ¼ to 1 minute are stained brown or light blue where the structure is martensitic; dark blue or dark grey where there is troostite; and hardly stained at all on ferrite or pearlite.

By treating hardened articles in this way, before viewing, inequalities are rendered visible and can readily be detected. The fact that the whole of the surface is tested, and not merely the parts touched by the file, sclerometer or scleroscope is an enormous advantage for commercial purposes. The test reveals at once spots that have been splashed before quenching, and contain troostite, also superficial tempering due to a glazed surface on the grind-

ing wheel or to excessive pressure. It does not appear to be possible to obtain a colorimetric scale of hardness in this way, but when a number of articles are dipped at the same time the eye readily detects those that have a different appearance, and all that is then necessary is to check the odd ones with a file or sclerometer. This test is also suitable for tools and complicated articles that cannot conveniently be tested with an instrument. It also shows the depth of case if a part is left on and ground away, and should prove useful for ascertaining whether an article has been properly tempered.

Standard Machine Tool Motors

(*Continued from page* 844.)

speed motor would only run a percentage of the time on high speed. Adjustable speed motors are more generally geared and their speeds should be governed by the proper gear speed.

There should be little difficulty in arriving at a proper shaft diameter and key for a given horsepower and speed motor. The length of shaft might offer some difficulty.

A uniformity of frame dimensions is obviously impossible, but much can be done to reduce the large variety of dimensions to perhaps two or three sizes per frame. There is, of course, no reason why there should not be a uniform drilling of the feet in the frame. It is not only important but absolutely necessary to consider seriously the item of drive in order to arrive at some basis upon which properly to determine the best speeds, shaft dimensions, etc., to standardize. Uniformity in making motor terminals, wiring diagrams, protecting live parts, etc., are of advantage to all concerned.

The machine user will derive considerable advantage from the standardization of motor parts as well as the machine manufacturer. The importance of the motor-driven machine tool with relation to production has become such that the method of applying the motor to the tool, in my opinion, warrants far more attention than has been given to it in the past by some of the tool manufacturers; and I trust that before another year elapses that the motor manufacturers and the machine manufacturers will each have a better understanding of the difficulties of the other, and that much will have been accomplished toward establishing suitable standards.

Illinois is producing 62,000,000 tons of coal per year, more than one-eighth of all the bituminous coal mined in the United States. The safety of the miners and the efficiency of the mining methods employed in the state are therefore matters of national concern.

The department of mining and engineering of the University of Illinois, the State Geological Survey and the United States Bureau of Mines have co-operated during the past three years to study Illinois mining conditions. The information collected at 100 mines is published in district reports. In Bulletin No. 2, Coal Mining Practice in District VIII (Danville), by S. O. Andros, are discussed causes of accidents to miners in Vermilion and Edgar counties, loss of natural resources by wasteful methods of blasting and mining, use of steel and concrete as substitutes for timber in the mines and other phases of underground mining. The bulletin also contains a description of the methods of removing the overburden from a coal bed by steam shovel, a system of mining which has been highly developed in this district. Copies of the bulletin may be obtained by addressing State Coal Mining Investigations, Urbana, Illinois

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Minimum, 50 words, $1.00. Each additional word, 2c. All capitals, 50 words, $1.50. Each additional word, 3c.

Position Wanted
Minimum, 25 words, 50c. Each additional word, 2c. All capitals, 25 words, 75c. Each additional word, 3c.

Miscellaneous Classified
Minimum, 25 words, $1.00. Each additional word, 4c. All capitals, 25 words, $2.00. Each additional word, 8c.

Men Wanted

ENGINEERS, SUPERINTENDENTS, foremen. Designers and Executive Office Men wanted; also cost accountants and experienced engineering salesmen. State fully experience in first letter. The Engineering Agency, Inc., 20th year, Chicago.

WANTED:—AN UP-TO-DATE CLERK for blast furnace office; experienced in above line and used to handling typewriter. Answer giving references to Box 137, THE IRON TRADE REVIEW, Cleveland, O.

WANTED BY COMPANY OPERATING two merchant blast furnaces, master mechanic of wide blast furnace experience especially as to steam. State age, experience, references, salary desired and when prepared to make engagement. Address Box 144, THE IRON TRADE REVIEW, Cleveland, O.

WANTED AT ONCE. — DESIGNING draftsman, experienced in crane and hoisting machinery. Also first-class structural steel designer. State experience, age, whether married or single, references, salary expected and how soon can report. Good opportunity for right men. Excellent location. Middle west. Address Box 148, THE IRON TRADE REVIEW, Cleveland, O.

WANTED—STEEL FOUNDRY FOREman for converter foundry in northern Ohio producing 75 tons high quality small steel castings per month. Both green and dry sand. Applicant must be practical molder, temperate and industrious and have ability to produce highest grade castings. Open shop and no labor trouble. State age, experience and salary expected. Address Box 149, THE IRON TRADE REVIEW, Cleveland, O.

IF ACTUALLY QUALIFIED FOR EXecutive, technical, professional, or administrative position between $2,500 and $12,000; communicate confidentially with undersigned counsel. Give name and address only for preliminary details; strictest privacy and safety assured. R. W. Bixby, Lock Box 134-C5, Buffalo, N. Y.

THE BEST WAY TO GET A GOOD POsition in drafting or engineering is to file an application direct with some of our clients who are depending on us to get competent and experienced applicants for their vacant positions. Send stamp for blank and list of vacant positions. The Cleveland Engineering Agency Co., Rose building, Cleveland, O.

WANTED—A COMPETENT INSTRUCTor in a large malleable shop to break in green help on light work and to increase production of present molders. Must be good molder himself and entirely familiar with molding machines, match plates, etc. State age, references, wages expected. Address Box 153, THE IRON TRADE REVIEW, Cleveland, O.

WANTED:—A GRAY IRON FOUNDRY foreman to act as superintendent as well as foreman, of small piece work shop, employing from 15 to 25 molders. Must be able to take entire charge in every respect, from keeping the shop in repair to laying out work and making up rigging, with the help of a pattern maker. Must have had experience with molding machines: squeezers; bench work and light floor work, and should have enough courage to tackle a badly disorganized shop where everything is going wrong, except the day's work, which is good. Several men have tackled this job, but have failed; if you have ever taken a shop in which the scrap was high; the iron dead; the system disorganized, and the equipment neglected, but not ruined, and have made a success of it, you are the man we want and your future will be in proportion to your ability. If your references are good enough, and you know your business well enough, the shop will be turned over to you for sixty days and you will not be interfered with in any way. This will allow you to make a success of things in your own way. If you have not perfect confidence in your ability to go up against a hard proposition of this sort, do not write; if you can handle it and have the confidence and courage necessary, write fully, giving references and experience. Salary $150 per month. No labor troubles, whatever. Address Box 156, THE IRON TRADE REVIEW, Cleveland, O.

Positions Wanted

COST ACCOUNTANT.—TAKE CHARGE of time-keeping, labor distribution, inventories, material costs, proper distribution of overhead, records of efficiency, show leaks and wastes, obtain accurate costs. Address Box 134, THE IRON TRADE REVIEW, Cleveland, O.

AS FOREMAN OF PATTERN SHOP. Over 12 years as foreman employing from 20 to 100 men. Broad experience with molding machines, gas and oil engines, and electrical machinery. Address Box 987, THE IRON TRADE REVIEW, Cleveland, O.

WANTED: — POSITION AS SUPERINtendent or foreman by a thoroughly practical and capable man of 20 years experience in erecting iron stairways, railings, store fronts, and general ornamental iron work. Address Box 108, THE IRON TRADE REVIEW, Cleveland, O.

POSITION WANTED BY EXPERIENCED draftsman on rolling mill work and machinery design. Age 36. Address Box 991, THE IRON TRADE REVIEW, Cleveland, O.

A TRAINED BUSINESS MAN OF 35 with ability to analyze, decide, plan, delegate and act; experienced in finance, costs, credits, accounts, sales, purchases, in fact all branches of manufacturing business, wishes, for excellent reasons, to make a change. At present general manager of a corporation, before that secretary and treasurer. Good record, gilt edged references. Address Box 147, THE IRON TRADE REVIEW, Cleveland.

SITUATION WANTED—A COMPETENT man is open for engagement to take charge of boiler-plate or structural shop. Address Boiler Maker, THE IRON TRADE REVIEW, Cleveland, O.

METALLURGICAL ENGINEER, NOW employed as such on large Iron and Steel plant, desires change. Technical graduate, fifteen years' practical experience covering by-products coke, blast furnace, open hearth, electric furnace, sheet, tube, rod, rail and plate mill practice. Good supervisor or technical assistant to General Manager. Prefers opportunity for investigation and development of special processes. Address Box 124, THE IRON TRADE REVIEW, Cleveland, Ohio.

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SITUATION WANTED IN SALES DEpartment. Graduate chemist—metallographer (26) with 4 years' experience in analytical and research work, wishes to become allied with company desiring to train man with technical knowledge to its business methods. Employed, single. Address Box 154, THE IRON TRADE REVIEW, Cleveland, O.

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ENGINEER.—MECHANICAL AND METallurgical—12 years' iron and steel industry, seeks Pittsburgh and vicinity sales agency for foundry, steel mill, supply or machinery products. Can handle the engineering and technical end in the promotion of sales. Address Box 121, THE IRON TRADE REVIEW, Cleveland, O.

MAN WITH BOSTON OFFICE WANTS to represent steel company in New England. Long experience as managar steel warehouse business in Boston. Might also carry stock. Address Box 142, THE IRON TRADE REVIEW, Cleveland, Ohio.

SALESMAN WITH OFFICE AND FAcilities would like to represent manufacturer and attend to New England inquiries. Address MACHINERY, 6 Beacon St., Boston, Mass.

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FOR SALE: — LARGE DEPOSITS OF high grade iron ore direct from farmers in Kentucky, far below their real value. W. S. Lowery, Marion, Ky.

FOR SALE:—FOUNDRY IN CENTRAL Ohio, fully equipped and running, contracts extending till March 1, 1915. Invoices $8,000, will sell for half to cash buyer. Owner wishes to retire on account of health. Address Box 151, THE IRON TRADE REVIEW, Cleveland, O.